SOIL SURVEY OF

Gunnison Area, Colorado

Parts of Gunnison, Hinsdale, and Saguache Counties

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Colorado Agricultural Experiment Station

Major fieldwork for this soil survey was done in the period 1958–64. Soil names and descriptions were approved in 1969. Unless otherwise indicated, statements in the publication refer to conditions in the Area in 1964. This survey was made cooperatively by the Soil Conservation Service and the Colorado Agricultural Experiment Station. It is part of the technical assistance furnished to the Gunnison Soil Conservation District.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing ranches and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for native hay and range grasses.

Locating Soils

All the soils of the Gunnison Area are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The Guide to Mapping Units can be used to find information. This guide lists all the soils of the survey area in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the capability unit and range site to which the soil has been assigned.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the descriptions of the capability units, range sites, and woodland groups.

Foresters and others can refer to the section Woodland, where the soils of the survey area are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the description of the soil associations and in the section Recreation.

Ranchers and others can find, under Use of the Soils for Range, groupings of the soils according to their suitability for range, and also the names of many the plants that grow on each range site.

Community planners and others concerned with recreation development can find, in the section Recreation, information about the relative limitations of different parts of the survey area for cottages and camps, picnic areas, and other vacation facilities.

Engineers and builders can find, under Engineering Uses of the Soils, tables that contain estimates of soil properties and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section Formation and Classification of the Soils.

Newcomers in the Gunnison Area may be especially interested in the section General Soil Map, where broad patterns of soils are described. They may also be interested in the information about the survey area given in the section General Nature of the Area.

Cover: **Dry Mountain Loam and Mountain Loam range sites, near Cochetopa Park, on Parlin-Lucky-Hopkins soil association.**

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SOIL SURVEY OF THE GUNNISON AREA, COLORADO

PARTS OF GUNNISON, HINSDALE, AND SAGUACHE COUNTIES

BY WILLIAM R. HUNTER AND CLAYTON F. SPEARS, SOIL CONSERVATION SERVICE

FIELDWORK BY WILLIAM R. HUNTER, CLAYTON F. SPEARS, EVAN V. KLEVEN, RODNEY E. PREATOR, AND DONALD E. BOYER, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE COLORADO AGRICULTURAL EXPERIMENT STATION

THE GUNNISON AREA is in the west-central part of Colorado, just west of the Continental Divide (fig. 1). Most of the survey area is in the southwestern part of Gunnison County. Part of it extends into Hinsdale and Saguache Counties. The total area is 803,000 acres, or 1,256 square miles. It is about 42 miles wide from east to west, and about 30 miles long from north to south. Gunnison is the county seat of Gunnison County.

Topographic differences and the resulting wide extremes of climate are typical both locally and throughout the survey area. Gunnison, for example, has an average frost-free season of about 71 days and about 11 inches of precipitation. Crested Butte has an average frost-free season of about 51 days and about 30 inches of precipitation. Frost, however, can occur at either location at any time during the year.

The Gunnison Area is drained by the Gunnison River and its tributaries. Elevations range from 7,100 feet at the western edge, where the Gunnison River leaves the survey area, to 12,700 feet on the Cannibal Plateau in the extreme southern part. Nearly level flood plains, low terraces, and fans are along major streams and side drainageways. Interstream areas consist of moderately rolling to steeply rolling uplands dissected by long narrow ridges, mesas, and benches that slope toward the main valley of the Gunnison River.

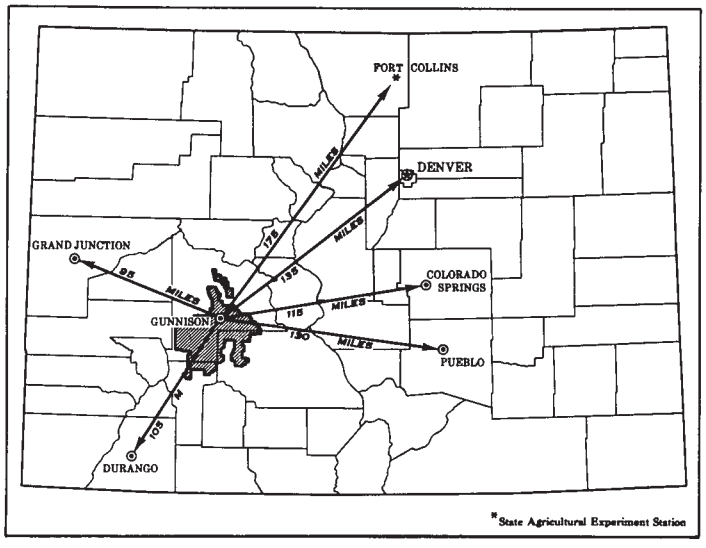

Figure 1.—Location of the Gunnison Area in Colorado.

Low rainfall, short frost-free periods, and low winter temperatures limit the survey area mostly to the production of native hay, range grasses, and woodland products. Irrigation is needed for hay and pasture grasses. About 40,000 acres in the Gunnison Area is irrigated.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in the Gunnison Area, where they are located, and how they can be used. The soil scientists went into the Area knowing they likely would find many soils they had already seen, and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Lucky

and Parlin, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Irim loam, 0 to 1 percent slopes, is one of two phases within the Irim series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of the Gunnison Area: soil complexes and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Youman-Leaps loams, 5 to 35 percent slopes, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." Uinta and Tolvar soils, 10 to 50 percent slopes, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Rockslides is a land type in the Gunnison Area.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and range, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in the Gunnison Area. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a survey area, who want to compare different parts of a survey area, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The six soil associations in the Gunnison Area are described in the following pages. The texture mentioned in the title of an association applies to the surface layer. For example, in the title of association 1, the words "loams and sandy loams" refer to the surface layer. Figure 2 shows the pattern of soils and parent material in associations 2, 3, 4, and 6.

1. Evanston-Gas Creek-Irim Association

Deep, nearly level to strongly sloping, well-drained, somewhat poorly drained, and poorly drained loams and sandy loams on flood plains, terraces, and alluvial fans

This association is along Tomichi, Ohio, Cochetopa, and Cebolla Creeks and the Gunnison and East Rivers. The nearly level soils are on flood plains near streams. The more sloping soils are on terraces and fans. The soils formed in alluvium that was derived from mixed rock sources. The vegetation is mainly sedges, rushes,

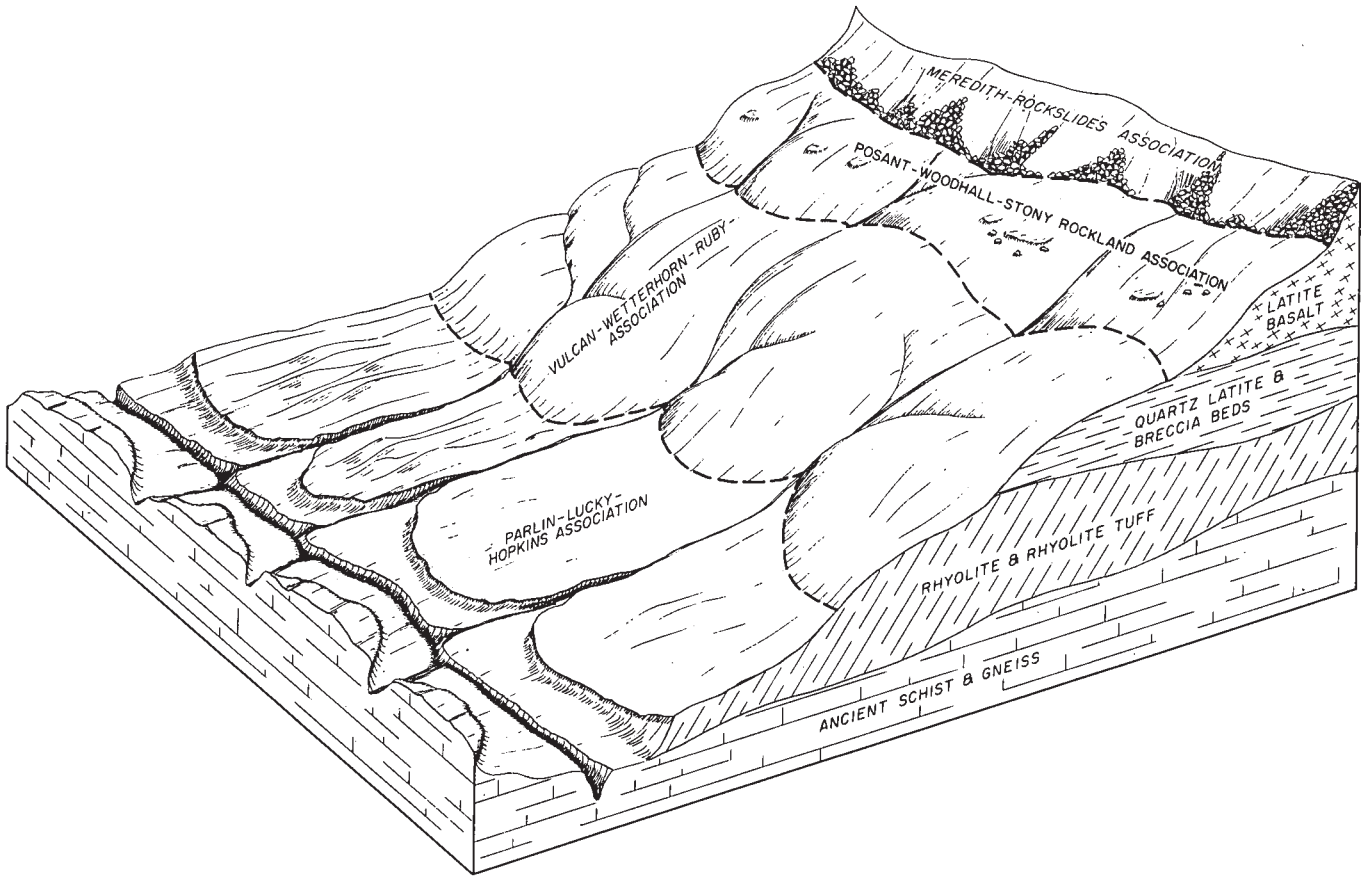

***Figure 2.*—Typical pattern of soils and parent material in associations 2, 3, 4, and 6.**

and cool-season grasses. Elevations range from about 7,500 to 9,500 feet. The average annual precipitation is 11 to 15 inches, average annual soil temperature at a depth of 20 inches is 46° F. or less, and the frost-free season is less than 75 days.

This association makes up about 8 percent of the survey area. It is about 30 percent Evanston soils, 20 percent Gas Creek soils, 10 percent Irim soils, 30 percent about equal parts Curecanti, Fola, Dewville, Bosler, and Gateview soils and Alluvial land, occasionally flooded, and 10 percent less extensive soils and miscellaneous land types.

Evanston soils are on alluvial fans. They are deep and well drained. The surface layer is loam. The subsoil is clay loam, and the substratum is loam.

Gas Creek soils are on flood plains. They are deep and poorly drained. The surface layer is sandy loam and very cobbly sandy loam. The underlying material is very cobbly sand.

Irim soils are on flood plains. They are deep and poorly drained. The surface layer is loam. The subsoil is mottled gravelly loam.

Nearly all of this association is irrigated and is used for hay (fig. 3) and pasture. The vegetation in unimproved meadow is commonly sedges, rushes, redtop, and bluegrass. Timothy, brome, orchardgrass, meadow fescue, and clover are dominant in improved fields. Continuous irrigation is common, especially early in summer when water is plentiful.

This association provides good habitat for cottontail rabbits, jackrabbits, snowshoe hare, mourning dove, sage grouse, and band-tailed pigeon. It also provides grazing for deer and elk. It has good potential as waterfowl habitat. Freezing temperature early in fall limits waterfowl hunting.

2. Parlin-Lucky-Hopkins Association

Deep and moderately deep, moderately sloping to steep, well-drained channery loams and gravelly sandy loams on hills, mountains, ridges, and benches

This association is on uplands. The landscape is one of hills and mountains dissected by valleys and swales, complex slopes and exposures, complex soil materials, and consequently, an intricate pattern of soils and vegetation. The soils formed in material weathered from rhyolite, tuff, gneiss, and schist. The dominant vegetation is fescue, wheatgrass, and big sagebrush (fig. 4). Elevations range from 7,500 to 9,000 feet. The average annual precipitation is 14 to 18 inches, average annual soil temperature at a depth of 20 inches is less than

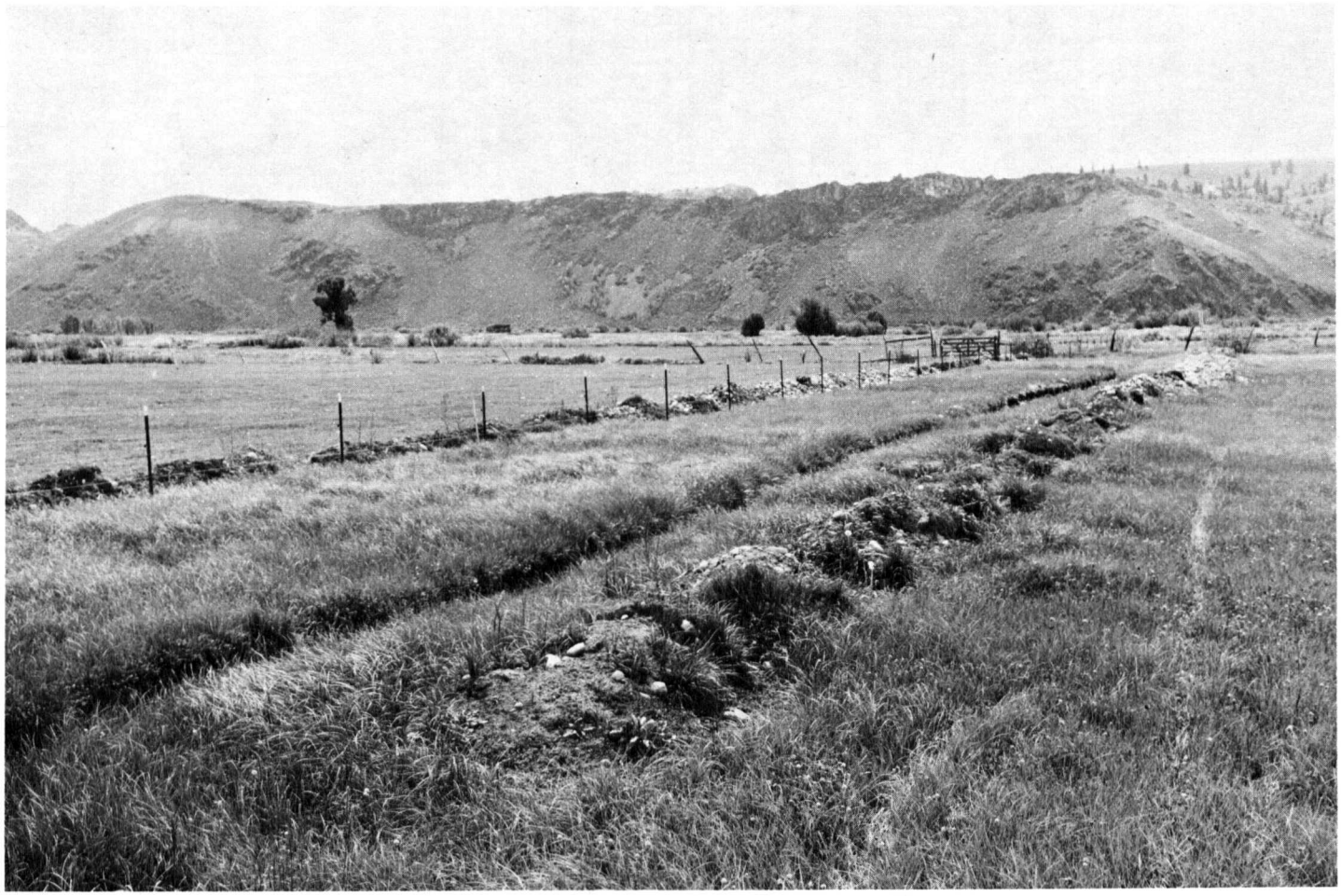

Figure 3.—**Meadow hay on poorly drained Gas Creek and Irim soils on flood plains.**

45° F., and the frost-free season is less than 75 days.

This association makes up about 45 percent of the survey area. It is about 30 percent Parlin soils, 20 percent Lucky soils, 10 percent Hopkins soils, 30 percent about equal parts Cheadle, Corpening, Duffson, Kezar, Redcloud, and Spring Creek soils and Stony rock land, and 10 percent less extensive soils and miscellaneous land types.

Parlin soils are deep and well drained. Their surface layer is channery loam. The subsoil is channery clay loam that grades to calcareous very stony loam at a depth of about 30 inches.

Lucky soils are moderately deep and well drained. Their surface layer is gravelly sandy loam. The subsoil is gravelly sandy clay loam that is underlain by gneiss or schist bedrock at a depth of about 28 inches.

Hopkins soils are deep and well drained. Their surface layer is channery loam. The underlying material is channery loam that grades to overlapping rhyolite flagstone.

Nearly all of this association is in range vegetation and is used for livestock and wildlife. Parlin and Lucky soils, on northern and eastern exposures, produce good forage. The dominant grasses are Arizona fescue, wheatgrass, mountain muhly, Idaho fescue, and native bluegrass. Big sagebrush is the dominant shrub. Hopkins soils are on dry southern and western exposures. The dominant vegetation in most areas is fringed sage, slimstem muhly, phlox, and bluegrass.

This association provides good habitat for mule deer, elk, cottontail rabbits, jackrabbits, and snowshoe hare, and for such upland birds as mourning dove, sage grouse, blue grouse, sharp-tailed grouse, and band-tailed pigeon.

3. Vulcan-Wetterhorn-Ruby Association

Deep and moderately deep, moderately sloping to steep, well-drained gravelly sandy loams and stony loams on mountains, ridges, and mesas

This association is on uplands, mostly in the southern part of the survey area. Small areas are in the extreme northern part. The soils formed in material that was derived from fine-grained igneous rock. The vegetation is mainly Engelmann spruce on Vulcan and Wetterhorn soils and cool-season grasses on Ruby soils. Elevations range from 8,500 to 11,000 feet. The average annual precipitation is about 20 to 25 inches. The average annual soil temperature at a depth of 20 inches is 38° F. to 46° F. Frost can occur during any month.

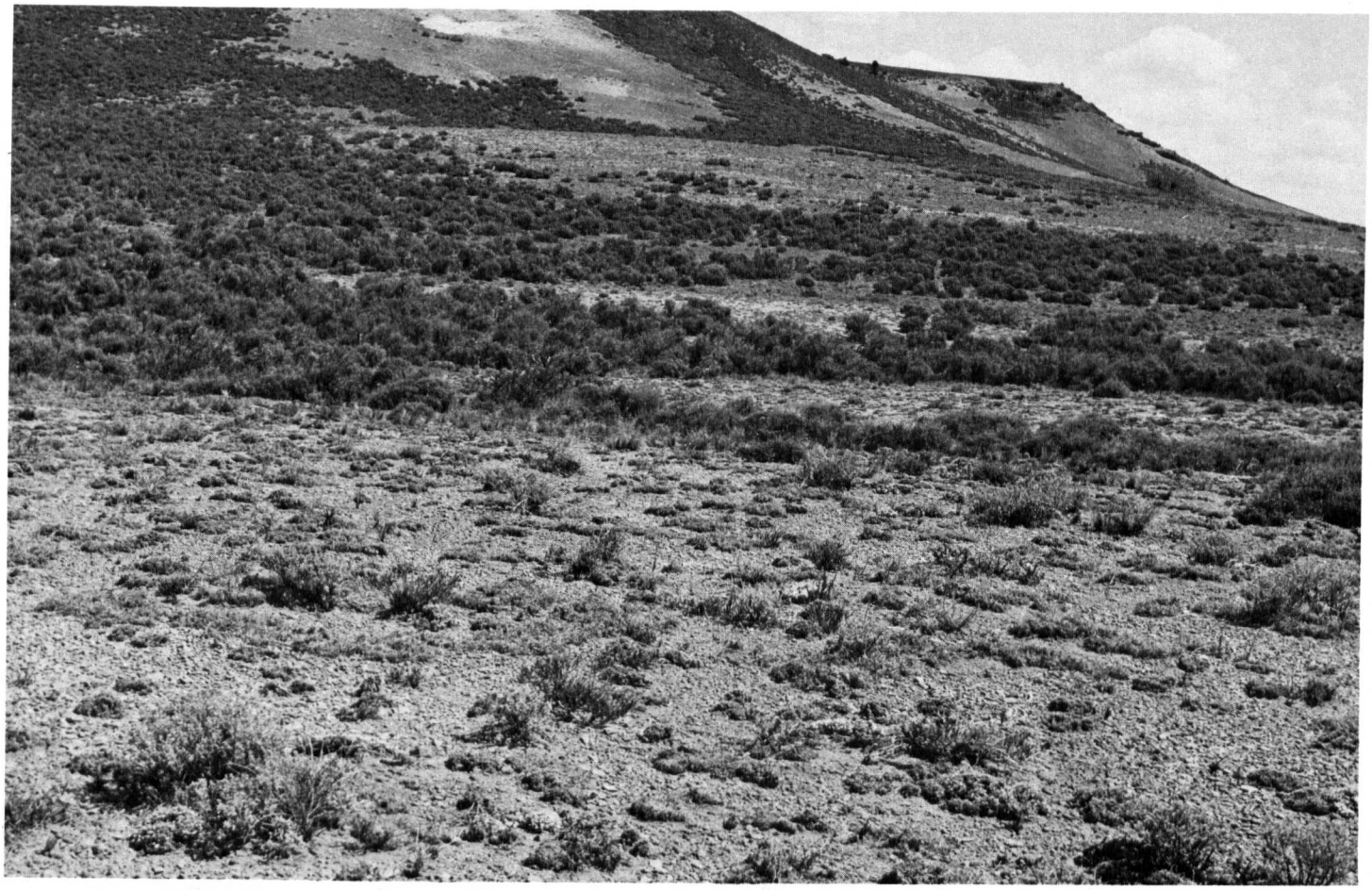

Figure 4.—**Sparse cover of fringed sage and slimstem muhly on Hopkins soils in foreground. Dense cover of big sagebrush and grasses on Parlin soils in background.**

This association makes up about 24 percent of the survey area. It is about 30 percent Vulcan soils, 15 percent Wetterhorn soils, 10 percent Ruby soils, 35 percent about equal parts Nutras, Bead, Cebolia, Cochetopa, Sunshine, Uinta, Mord, and Powderhorn soils and Stony rock land, and 10 percent less extensive soils and miscellaneous land types.

Vulcan soils are deep and well drained. They have a mat of needles and twigs on the surface. The mineral surface layer is very gravelly sandy loam. The subsoil is very stony and gravelly clay to a depth of 36 inches. Below this is overlapping rhyolite flagstone.

Wetterhorn soils are moderately deep and well drained. They have a mat of leaves and twigs on the surface. The mineral surface layer is stony loam. The subsoil is stony clay loam. Bedrock is at a depth of about 36 inches.

Ruby soils have a surface layer of gravelly sandy loam. The subsoil is gravelly clay loam. Highly fractured, overlapping rhyolite flagstone is at a depth of about 13 inches.

Nearly all of this association is in native vegetation and is used for range, timber, and wildlife. Forage production is high on Ruby soils. The vegetation is commonly Thurber fescue, Letterman needlegrass, Columbia needlegrass, bluegrass, and big sagebrush. Logging is common on Vulcan and Wetterhorn soils. The trees are Engelmann spruce, Douglas-fir, and aspen. Most of the area is covered with deep snow all winter and until late in spring. Snowmelt, which is a source of water for springs and streams, is slower on northern exposures and in timbered areas.

This association provides good habitat for mule deer, elk, snowshoe hare, mourning dove, and blue and sharp-tailed grouse. It provides good cover for mountain sheep and black bear.

4. Posant-Woodhall-Stony Rock Land Association

Shallow and moderately deep, moderately sloping to very steep, well-drained gravelly loams and stony and rocky areas on mountains, hills, and ridges

This association is in the southern part of the survey area along Cebolla Creek and the Lake Fork of the Gunnison River. The soils formed in material that was derived mainly from fine-grained igneous rock. The vegetation consists of open stands of conifers and an understory of big sagebrush and grass. Elevations range from 8,000 to 10,000 feet. The average annual precipitation is about 16 or 17 inches. The average

annual soil temperature at a depth of 20 inches is 42° to 44° F. Frost can occur during any month.

This association makes up 9 percent of the survey area. It is 30 percent Posant soils, 25 percent Woodhall soils, 20 percent Stony rock land, 20 percent about equal parts Wetterhorn, Nutras, Ruby, and Woosley soils, and 5 percent less extensive soils and miscellaneous land types. Rock outcrop is common in areas of Posant and Woodhall soils.

Posant soils are shallow and well drained. Their surface layer is gravelly loam. The subsoil is very gravelly heavy clay loam that is underlain by quartz latite at a depth of about 19 inches.

Woodhall soils are moderately deep and well drained. Their surface layer is gravelly loam. The subsoil is very stony clay loam that is underlain by fractured rhyolite at a depth of about 30 inches.

Stony rock land consists of exposed bedrock, loose stones, boulders, and very shallow soils.

This association is used for recreation, wildlife, woodland (fig. 5), and grazing. Most of the woodland has been logged for mine props, railroad ties, and lumber. Open stands of timber are grazed in summer. Dominant grasses are Arizona fescue, mountain muhly, junegrass, pine dropseed, and Indian ricegrass.

This association provides good habitat for mule deer, snowshoe hare, mourning dove, sharp-tailed grouse, blue grouse, and band-tailed pigeon. Deer and elk often graze the sunny slopes during the winter. Elk, however, utilize the area mainly for cover.

5. Shule-Youman-Passar Association

Moderately deep and deep, strongly sloping to steep, well-drained loams on alluvial fans, hills, ridges and mountains

This association is in the western part of the survey area. The landscape is one of long, somewhat rounded hills and ridges paralleled by open valleys that drain toward the main channel of the Gunnison River. Along deeply entrenched drainageways, vertical areas of rock outcrop are common. The soils formed in material that was derived from rhyolite and tuff. The vegetation on Shule soils is conifers and on Youman and Passar soils (fig. 6) big sagebrush, silver sagebrush, and cool-season grasses. Elevations range from 8,000 to 10,500 feet. The average annual precipitation is about 18 to 20 inches. The average annual soil temperature at a depth of 20 inches is 34° to 38° F. Frost can occur during any month.

This association makes up about 15 percent of the survey area. It is about 30 percent Shule soils, 25 per-

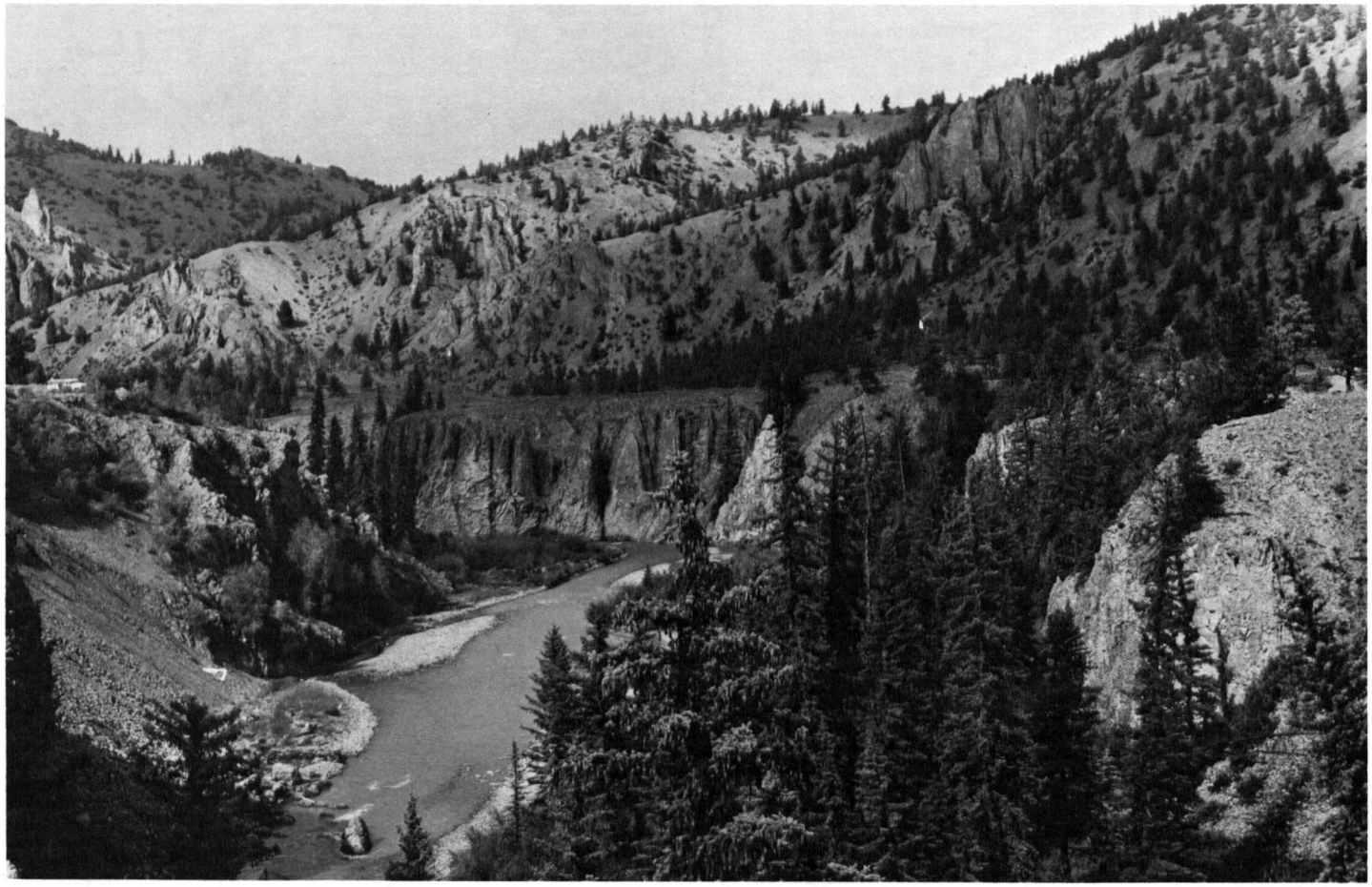

Figure 5.—**Open stands of conifers on Posant-Woodhall-Stony rock land soil association.**

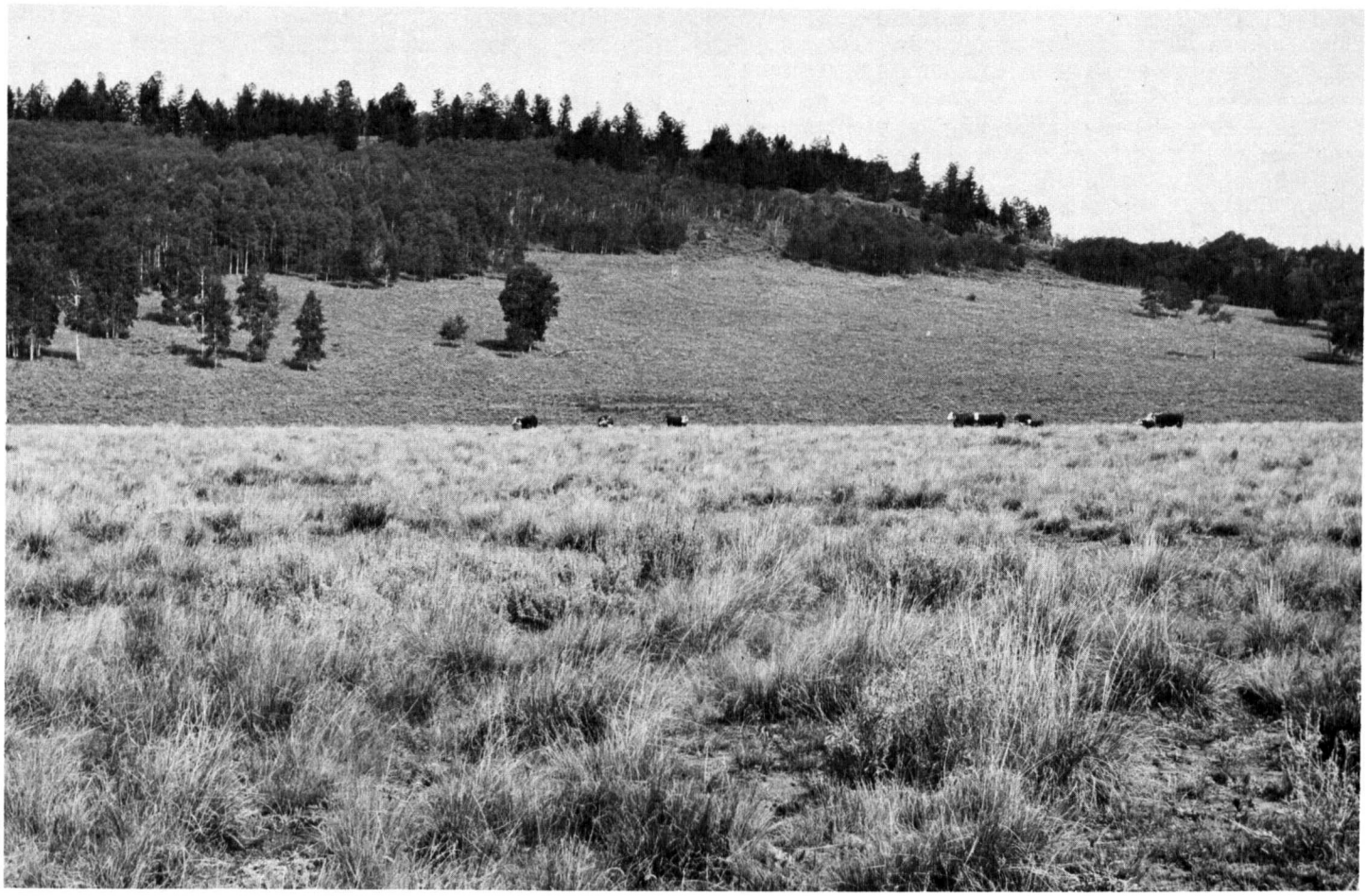

Figure 6.—**Youman and Passar soils in foreground provide good summer grazing for livestock. Trees in background are on Shule soils.**

cent Youman soils, 20 percent Passar soils, 15 percent Kubler and Sapinero soils, and 10 percent Stony rock land.

Shule soils are moderately deep and well drained. They have a mat of needles, leaves, and twigs on the surface. The mineral surface layer is loam. The subsoil is clay loam that is underlain by rhyolite at a depth of about 34 inches.

Youman soils are deep and well drained. Their surface layer is loam. The subsoil is heavy clay loam, and the substratum is heavy clay loam.

Passar soils are deep and well drained. Their surface layer is loam. The subsoil is extremely stony clay. The substratum is very stony clay loam.

Most of this association is in native vegetation and is used for timber, grazing, recreation, and wildlife. Forage production is high on Youman and Passar soils. Native grasses are Thurber fescue, nodding brome, native bluegrass, bearded wheatgrass, and timber oatgrass. Extensive logging is common on Shule soils. The dominant trees are Engelmann spruce, subalpine fir, and aspen. Snow covers the ground in winter and often remains until late in spring. Snowmelt, which provides a source of water for springs and streams, is slower on northern exposures and in timbered areas. Most streams flow the year round.

This association provides good habitat for mule deer, elk, black bear, mountain lion, snowshoe hare, mourning dove, sage grouse, sharp-tailed grouse, and blue grouse. Wild turkey can find good cover for roosting and concealment. Deer and elk inhabit the areas throughout the summer.

6. Meredith-Rockslides Association

Deep, stony, well-drained, strongly sloping to very steep soils and rockslides on mountain and alpine rimland

This association is in the extreme south-central part of the survey area. The landscape is one of long uniform slopes, ridges, and rimlands above timberline. The soils formed in stony colluvium that was derived from latite-basalt. The vegetation is alpine grasses, shrubs, and forbs. Elevations range from 11,000 to 12,600 feet. The average annual precipitation is about 30 inches, most of which falls as snow. The average annual soil temperature at a depth of 20 inches is 30° F. Frost occurs during all months.

This association makes up 1 percent of the survey area. It is about 60 percent Meredith soil, 35 percent Rockslides, and 5 percent less extensive soils and miscellaneous land types.

Meredith soil is deep and well drained. It has a thin

mat of partly decomposed plant material on the surface. The surface layer is very stony loam. The subsoil is very stony silt loam. The substratum is very stony silt loam several feet thick.

Rockslides consists of loose, angular stone fragments that range in size from gravel to boulders many feet in diameter. It is commonly on very steep upland slopes below Rock outcrop and rimland.

This association is used mostly for grazing sheep. The grazing season is short, commonly no longer than 2 months. The native vegetation is low-growing sedges, alpine bluegrass, moss campion, silver cinquefoil, and alpine willow. Rockslides provides water for lower areas. Winter snow accumulates in crevices between the stones and is slower to melt during spring thaw. Slower melting allows a more even distribution of water to springs and streams.

This association has good potential as habitat for elk, black bear, mountain sheep, ptarmigan, and snowshoe hare. It has good potential as cover for deer and mourning dove, but only fair potential for food.

Descriptions of the Soils

This section describes the soil series and mapping units in the Gunnison Area. Each soil series is described in considerable detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile; that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second, detailed and in technical terms, is for scientists, engineers, and others who need to make thorough and precise studies of soils. Unless it is otherwise stated, the colors given in the descriptions are those of a dry soil.

As mentioned in the section How This Survey Was Made, not all mapping units are of a soil series. Rock outcrop, for example, does not belong to a soil series, but nevertheless, is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, range site, or woodland group to which the mapping unit has been assigned. The page for the description of each capability unit and range site can be found by referring to the Guide to Mapping Units at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*4*).[1]

Alluvial Land

Alluvial land (Ad) is in narrow, winding valleys and on small fans and mountain toe slopes. It consists of an accumulation of valley-fill sediment that was derived from many kinds of rocks and upland soils. Some sediment has been carried for only short distances and has been sorted only slightly. Other sediment has been carried for considerable distances and has been well sorted and stratified. This land is subject to flooding and deposition of new sediment. Slopes are dominantly 0 to 5 percent, but they range to 15 percent.

Little or no soil formation has occurred in most areas. In some areas a thin, dark-colored, generally loamy surface layer has formed. The underlying material is highly stratified. Drainageways that are not protected by adequate plant cover are subject to entrenchment and headcutting. The water table in most areas has been lowered by the entrenchment of drainageways.

Alluvial land is used mainly for range, wildlife, and recreation. The vegetation is commonly grass and mixed stands of big sagebrush and grass. Areas above an elevation of 9,000 feet are forested. Capability unit VIw-3 nonirrigated; Mountain Swale range site.

Alluvial Land, Occasionally Flooded

Alluvial land, occasionally flooded (Ao) is on flood plains along streams and side drainageways. It consists of material recently deposited by streams. It varies widely in texture and commonly has very cobbly or stony areas interspersed throughout. It is subject to erosion from floods and changes in stream channels. Slopes are 0 to 5 percent.

Alluvial land, occasionally flooded, is suited to limited grazing and to wildlife and recreation. In most areas the vegetation is narrowleaf cottonwood, willows, grasses, sedges, and rushes. Small areas are flooded annually and support little or no vegetation. Capability unit VIIw-4 nonirrigated.

Alluvial Land, Wet

Alluvial land, wet (Aw) is commonly on flood plains and in narrow, winding valleys. It consists of deep, very poorly drained, dark-colored, stratified sandy loam to clay loam that was derived from mixed alluvium. Slopes are 0 to 5 percent.

This land receives water from springs and streams. The water table is at the surface or within a depth of 1 foot during most of the year. Organic-matter content is high. Buried surface layers, mottling, and gleying are common in most areas. Numerous stones and cobblestones are on the surface and throughout the soil material.

Alluvial land, wet, is used for range and wildlife. It can be irrigated and used for pasture. It has good plant cover and supports meadow vegetation, willows, and

[1] Italic numbers in parentheses refer to Literature Cited, p. 83.

TABLE 1.—*Approximate acreage and proportionate extent of the soils* [1]

Soil	Area	Extent	Soil	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Alluvial land	7,000	0.9	Lucky-Cheadle gravelly sandy loams, 5 to 45 percent slopes	76,700	9.6
Alluvial land, occasionally flooded	4,800	.6	Meredith very stony loam, 8 to 50 percent slopes	6,200	.8
Alluvial land, wet	7,200	.9	Mord loam, 5 to 30 percent slopes	6,800	.8
Bead fine sandy loam, 10 to 50 percent slopes	13,300	1.7	Morop stony loam, 5 to 40 percent slopes	1,100	.1
Big Blue loam, 0 to 1 percent slopes	1,100	.1	Nutras stony loam, 10 to 50 percent slopes	18,500	2.3
Big Blue loam, 1 to 5 percent slopes	900	.1	Parlin-Hopkins channery loams, 5 to 45 percent slopes	111,600	13.9
Bogan silt loam, 5 to 30 percent slopes	2,500	.3	Parlin-Mergel gravelly loams, 5 to 45 percent slopes	14,500	1.8
Bosler sandy loam, 1 to 8 percent slopes	3,700	.5	Posant very rocky loam, 10 to 60 percent slopes	19,900	2.5
Carbol very rocky sandy loam, 15 to 60 percent slopes	2,800	.4	Powderhorn loam, 5 to 30 percent slopes	5,000	.6
Cebolia loam, 5 to 30 percent slopes	11,000	1.4	Redcloud channery loam, 3 to 30 percent slopes	14,400	1.8
Cochetopa loam, 5 to 30 percent slopes	8,300	1.0	Rock outcrop	1,900	.2
Corpening fine sandy loam, 5 to 40 percent slopes	2,500	.3	Rockslides	5,200	.6
Curecanti gravelly loam, 1 to 8 percent slopes	4,900	.6	Ruby gravelly sandy loam, 5 to 30 percent slopes	14,800	1.8
Dewville loam, 1 to 5 percent slopes	1,400	.2	Ruby extremely rocky sandy loam, 5 to 40 percent slopes	6,300	.8
Dewville loam, 5 to 15 percent slopes	2,700	.3	Shule and Sapinero loams, 10 to 50 percent slopes	48,000	6.0
Dollard silty clay loam, 5 to 30 percent slopes	3,100	.4	Stony rock land	62,300	7.8
Duffson-Corpening loams, 5 to 35 percent slopes	36,600	4.6	Sunshine loam, 5 to 35 percent slopes	7,700	1.0
Duffson-Spring Creek stony loams, 5 to 40 percent slopes	30,600	3.8	Tongue River loam, 10 to 50 percent slopes	3,300	.4
Evanston loam, 1 to 5 percent slopes	6,300	.8	Uinta and Tolvar soils, 10 to 50 percent slopes	14,600	1.8
Evanston loam, 5 to 20 percent slopes	9,200	1.1	Vulcan gravelly sandy loam, 10 to 35 percent slopes	42,300	5.3
Fola cobbly sandy loam, 1 to 8 percent slopes	5,900	.7	Wetterhorn stony loam, 10 to 55 percent slopes	27,800	3.5
Gas Creek sandy loam, 0 to 1 percent slopes	8,300	1.0	Woodhall extremely rocky loam, 5 to 50 percent slopes	15,800	2.0
Gas Creek sandy loam, 1 to 5 percent slopes	1,900	.2	Woosley very rocky loam, 10 to 60 percent slopes	3,200	.4
Gateview cobbly loam, 2 to 8 percent slopes	2,200	.3	Youga loam, 3 to 30 percent slopes	2,800	.3
Gateview cobbly loam, 8 to 30 percent slopes	3,300	.4	Youman-Leaps loams, 5 to 35 percent slopes	4,600	.6
Gold Creek silty clay loam, 0 to 5 percent slopes	1,700	.2	Youman-Passar loams, 5 to 30 percent slopes	43,700	5.4
Irim loam, 0 to 1 percent slopes	1,100	.1	Total	803,000	100.0
Irim loam, 1 to 5 percent slopes	4,200	.5			
Jerry loam, 5 to 30 percent slopes	1,400	.2			
Kezar-Cathedral gravelly sandy loams, 5 to 35 percent slopes	17,600	2.2			
Kubler loam, 5 to 35 percent slopes	13,700	1.7			
Leaps silty clay loam, 5 to 30 percent slopes	2,800	.4			

[1] Blue Mesa Reservoir, completed after the soil survey, now covers 9,180 acres.

narrowleaf cottonwood. Capability unit VIw-1 irrigated; Mountain Meadow range site.

Bead Series

The Bead series consists of deep, well-drained, medium acid soils on upland hills and valley sides. Slopes are 10 to 50 percent. These soils formed in stony residuum, alluvium, and colluvium that were derived from sandstone and sandy shale.

Typically, these soils have a 4-inch mat of undecomposed and partly decomposed organic material. In a representative profile the mineral surface layer is pinkish-gray fine sandy loam about 5 inches thick. The next layer is 13 inches of pinkish-gray and light reddish-brown sandy clay loam. The subsoil is reddish-brown stony clay about 22 inches thick. The substratum is very stony clay or heavy clay loam that is more than 35 percent angular sandstone fragments.

Bead soils are at elevations of 9,000 to 10,500 feet. They receive 20 to 25 inches of precipitation annually. The average annual soil temperature is 38° F. The vegetation is commonly Engelmann spruce, subalpine fir, and aspen.

Permeability is slow. The root zone is 60 inches deep or more. Available water capacity is high.

Bead soils are important in timber production. They provide wildlife habitat and are also used for watershed.

Representative profile of Bead fine sandy loam, 10 to 50 percent slopes; NE1/4 sec. 3, T. 46 N., R. 1 W., Saguache County:

O1—4 to 2 inches, organic material consisting of needles, twigs, and bark.

O2—2 inches to 0, partly decomposed organic material.

A2—0 to 5 inches, pinkish-gray (7.5YR 7/2) fine sandy loam, brown (7.5YR 5/3) moist; weak platy structure parting to moderate, fine, granular; soft, very friable; 5 percent sandstone fragments; pH 6.0; clear, wavy boundary.

A&B—5 to 18 inches, pinkish-gray (7.5YR 7/2) and light reddish-brown (5YR 6/4) sandy clay loam, light gray (7.5YR 6/2) and reddish brown (5YR 5/3) moist; weak, medium, subangular blocky structure parting to moderate, fine, granular; hard, very friable; 5 percent sandstone fragments of stone size; pH 5.5; gradual, wavy boundary.

B2t—18 to 40 inches, reddish-brown (5YR 5/4) stony clay, reddish brown (5YR 4/4) moist; strong, medium, subangular blocky structure parting to strong, fine, subangular and angular blocky; extremely hard, firm; thin continuous clay films on ped faces; 20

percent sandstone fragments; pH 5.5; gradual, smooth boundary.

C—40 to 60 inches +, light reddish-brown (5YR 6/4) very stony clay, reddish brown (5YR 5/4) moist; massive; extremely hard, firm; 40 percent angular sandstone; pH 6.0.

In places this soil has a dark-colored surface layer. The A2 horizon ranges from 4 to 12 inches in thickness. The B2t horizon generally is stony clay, but ranges to clay loam or stony clay loam. The content of rock fragments, mostly stones, in the A2 and B2t horizons ranges from 5 to 35 percent and increases with increasing depth.

Bead fine sandy loam, 10 to 50 percent slopes (BaF).—This soil is in the southern part of the survey area and near Crested Butte. In old burned areas under a cover of aspen, a 2- to 3-inch dark-colored surface layer is common.

Included with this soil in mapping are areas of Cebolia soils and small areas where slopes are either steeper or less steep. Also included in the Crested Butte area are soils that have a stony clay loam subsoil and sandstone at a depth of 30 to 40 inches, but are otherwise similar to Bead soils. Included soils make up less than 10 percent of the total acreage.

Almost all the acreage is wooded, mainly with Engelmann spruce and subalpine fir at higher elevations and Douglas-fir at lower elevations. Mixed aspen and conifers grow at all elevations where the original cover has been destroyed by fire or logging. Runoff is rapid, and the erosion hazard is moderate to high. Capability unit VIIe-2 nonirrigated; woodland group 3.

Big Blue Series

The Big Blue series consists of deep, poorly drained soils on flood plains and low terraces. Slopes are 0 to 5 percent. These soils formed mainly in fine-textured alluvium of mixed origin.

Typically, these soils are stratified and have a 3-inch mat of roots. In a representative profile the surface layer is calcareous, dark-gray loam and clay about 21 inches thick. The subsoil is gleyed and mottled olive and light greenish-gray heavy clay loam about 31 inches thick. The substratum to a depth of 60 inches is stratified gravel and sand.

Big Blue soils are at elevations of about 7,800 to 8,500 feet. The average annual precipitation is 14 inches, and the average annual soil temperature is 42° F. The vegetation is commonly timothy, alsike clover, redtop, fescue, sedges, and rushes.

Permeability is slow. The water table is at or near the surface part of the year but fluctuates within a depth of 3 feet. The root zone is 60 inches deep, or more, and available water capacity is high.

These soils are used as pasture.

Representative profile of Big Blue loam, 1 to 5 percent slopes; SE1/4 sec. 13, T. 48 N., R. 3 E., Saguache County:

O1—3 inches to 0, root mat.

A11—0 to 10 inches, dark-gray (10YR 4/1) loam, black (10YR 2/1) moist; weak, medium, platy structure parting to moderate, medium, granular; soft, very friable; moderately calcareous; pH 8.0; clear, smooth boundary.

A12g—10 to 21 inches, dark-gray (10YR 4/1) clay, black (10YR 2/1) moist; moderate, medium, granular structure parting to moderate, fine, granular; slightly hard, friable; slightly calcareous; pH 8.2; clear, wavy boundary.

B21g—21 to 32 inches, gray (5Y 5/1) heavy clay loam, dark gray (5Y 4/1) moist; many medium and large, prominent, olive (5Y 5/6) mottles; massive; hard, friable; pH 8.1; gradual, smooth boundary.

B22g—32 to 40 inches, gray (5Y 6/1) heavy clay loam, dark gray (5Y 4/1) moist; many, medium and large, prominent, olive (5Y 5/6) mottles; massive; very hard, firm; pH 7.8; gradual, smooth boundary.

B23g—40 to 52 inches, light greenish-gray (5BG 7/1) clay loam, greenish gray (5BG 5/1) moist; many, medium and coarse, prominent, olive (5Y 5/6) mottles; massive; extremely hard, very firm; 10 percent gravel; pH 8.4; gradual, wavy boundary.

IIC—52 to 60 inches, gravel, sand, and cobblestones; single grained; loose.

In undisturbed areas the O1 horizon is typically 2 to 4 inches thick. The A11 horizon is typically loam, but ranges to light clay loam. It ranges from dark gray to very dark gray. Depth to the IIC horizon ranges from 40 to more than 60 inches.

Big Blue loam, 0 to 1 percent slopes (BbA).—This soil is ordinarily in old oxbows and slack water areas, away from the main stream channel. It is saturated about 8 months out of the year. Small areas are sometimes flooded.

Included with this soil in mapping are small areas of Gas Creek, Gold Creek, and Irim soils. Excessively wet areas are identified by spot symbols on the map. Included soils make up about 10 percent of the total acreage.

Most of the acreage is used for native hay and pasture. Runoff is very slow, and the erosion hazard is slight. Capability unit Vw-1 irrigated.

Big Blue loam, 1 to 5 percent slopes (BbB).—This soil is along streams and tributaries. It has the profile described as representative of the series. It is saturated throughout for short periods.

Included with this soil in mapping are a few areas of Gold Creek soils adjacent to the main stream channels and small areas of Gas Creek soils in old stream channels and on gravel bars. Included soils make up about 5 percent of the total acreage.

This soil is used mainly for hay and pasture. Runoff is slow, and the erosion hazard is slight to moderate. Capability unit Vw-2 irrigated.

Bogan Series

The Bogan series consists of moderately deep, well-drained soils on uplands. Slopes are 5 to 30 percent. These soils formed in material derived in place from interbedded shale and fine-grained sandstone.

In a representative profile the surface layer is dark-brown silt loam about 8 inches thick. The subsoil is brown silt loam and pale-brown light silty clay loam about 16 inches thick. Soft, yellowish-brown shale interbedded with fine-grained sandstone is at a depth of 24 inches.

Bogan soils are at elevations of 9,000 to 10,000 feet. The climate is cool and humid. The average annual soil temperature is about 37° F. The average annual precipitation is about 20 inches. The vegetation is commonly big sagebrush, silver sagebrush, Thurber fescue, Letterman needlegrass, nodding brome, and scattered clumps of aspen trees.

Permeability is moderate. The root zone is 20 to 40 inches deep. Available water capacity is low.

Bogan soils are important for range, and they provide habitat for wildlife.

Representative profile of Bogan silt loam, 5 to 30 percent slopes, three-fourths of a mile east of Baldwin; NE1/4 sec. 7, T. 15 S., R. 86 W., Gunnison County:

A1—0 to 8 inches, dark-brown (10YR 3/3) silt loam, very dark brown (10YR 2/3) moist; weak, very fine, granular structure; soft, very friable; pH 6.6; clear, smooth boundary.

B1—8 to 16 inches, brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate, medium, subangular blocky structure; hard, firm; thin continuous clay films on ped faces; pH 7.0; clear, smooth boundary.

B2t—16 to 24 inches, pale-brown (10YR 6/3) light silty clay loam, dark grayish brown (10 YR 4/2) moist; moderate and strong, fine, subangular blocky structure; hard, firm; moderate continuous clay films on ped faces; pH 6.7; clear, smooth boundary.

R—24 inches +, yellowish-brown shale interbedded with fine-grained sandstone.

The A1 horizon is dominantly silt loam, but ranges to fine sandy loam and loam. It ranges from dark brown to brown. The B2t horizon is typically light silty clay loam, but in places is clay loam. It ranges from 6 to 12 inches in thickness. Sandstone or interbedded sandstone and sandy shale is at a depth of 20 to 40 inches. Bogan soils are commonly noncalcareous, but limy horizons occur in places.

Bogan silt loam, 5 to 30 percent slopes (BoE).—This soil is on uplands in the northern part of the survey area along Ohio Creek and its tributaries and near Crested Butte.

Included with this soil in mapping are areas of Cochetopa and Tongue River soils and small areas, commonly near Crested Butte, of soils that are only 10 to 20 inches deep over shale, but are otherwise similar to Bogan soils. Included soils make up 15 percent of the total acreage.

Almost all the acreage is in native vegetation and is used for grazing, wildlife, and recreation. Small, less sloping areas below irrigation ditches are irrigated to produce hay and pasture. Runoff is medium. Slight to moderate erosion is common. The erosion hazard is moderate. Capability units VIe-1 irrigated, VIe-4 nonirrigated; Subalpine Loam range site.

Bosler Series

The Bosler series consists of deep, well-drained soils on terraces and alluvial fans. Slopes are 1 to 8 percent. These soils formed in mixed alluvium, sand, and gravel.

In a representative profile the surface layer is brown sandy loam about 10 inches thick. The subsoil is brown sandy loam and brown and grayish-brown gravelly sandy clay loam about 22 inches thick. It is calcareous in the lower part. The substratum to a depth of 72 inches is calcareous, white very cobbly loamy sand and cobbly sand.

Bosler soils are at elevations of 7,800 to 8,500 feet. The average annual soil temperature is 41° F. The average annual precipitation is approximately 11 inches. The native vegetation is commonly Arizona fescue, squirreltail, and big sagebrush.

Permeability is moderate. Roots can penetrate to a depth of 60 inches or more, but available water capacity is low.

If irrigated, these are important soils for hay and pasture.

Representative profile of Bosler sandy loam, 1 to 8 percent slopes, one-fourth mile north of Gunnison; NW1/4 sec. 36, T. 50 N., R. 1 W., Gunnison County:

A1—0 to 10 inches, brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak, fine, granular structure; slightly hard, very friable; about 5 percent gravel; pH 7.2; clear, smooth boundary.

B1—10 to 22 inches, brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak, coarse, subangular blocky structure; slightly hard, very friable; about 5 percent gravel; pH 7.4; clear, wavy boundary.

B2t—22 to 26 inches, brown (7.5YR 5/3) gravelly sandy clay loam, dark brown (7.5YR 4/3) moist; moderate, medium, subangular blocky structure; hard, friable; thin continuous clay films on ped faces; about 40 percent gravel and cobblestones; clear, irregular boundary.

B3ca—26 to 32 inches, grayish-brown (10YR 5/2) gravelly sandy clay loam, dark grayish brown (10 YR 4/2) moist; weak, medium, subangular blocky structure; hard, very friable; thin patchy clay films; about 40 percent gravel and cobblestones; strongly calcareous; pH 7.6; gradual, wavy boundary.

IIC1ca—32 to 48 inches, white (10YR 8/2) very cobbly loamy sand, very pale brown (10YR 7/3) moist; massive; hard, very friable; strongly calcareous; pH 8.0; clear, wavy boundary.

IIC2—48 to 72 inches, cobbly sand.

The A horizon is typically sandy loam, but in places is loam. The B2t horizon is 35 to 65 percent gravel and cobblestones. It ranges from 4 to 12 inches in thickness. Reaction is neutral to moderately alkaline.

Bosler sandy loam, 1 to 8 percent slopes (BsB).—This soil is on terraces and alluvial fans along major streams and side drainageways. Terraces are normally 30 to 60 feet above streams.

Included with this soil in mapping are areas of Curecanti and Fola soils in narrow bands along terrace edges and areas of Evanston and Dewville soils on small fans. Steep, cobbly terrace edges are common. Included soils make up about 15 percent of the total acreage.

About three-fourths of the acreage is used for irrigated hay and pasture. The rest is native range. Runoff is slow, and the erosion hazard is slight. Capability units Vc-1 irrigated, VIe-2 nonirrigated; Mountain Outwash range site.

Carbol Series

The Carbol series consists of shallow, well-drained soils on hillsides and mountainsides. Slopes are 15 to 60 percent. These soils formed in material derived in place from granite.

In a representative profile the surface layer is very dark grayish-brown gravelly sandy loam about 8 inches thick. The subsoil is dark-brown gravelly sandy clay loam about 8 inches thick. Unweathered granite is at a depth of 16 inches.

Carbol soils are at elevations of about 9,000 to 10,000 feet. The average annual soil temperature is 38° F., and the average annual precipitation is about 17 inches. The vegetation is commonly thin stands of ponderosa pine and Douglas-fir and an understory of big sagebrush, Arizona fescue, pine dropseed, and Indian ricegrass.

Permeability is moderately rapid. Roots can penetrate to a depth of only 10 to 20 inches, and available water capacity is low.

These are important soils for timber production and range, and they provide habitat for wildlife.

Representative profile of Carbol very rocky sandy loam, 15 to 60 percent slopes, in a road cut on a south-facing slope of 28 percent; sec. 26, T. 46 N., R. 1½ W., Gunnison County:

A1—0 to 8 inches, very dark grayish-brown (10YR 3/2) gravelly sandy loam, very dark brown (10YR 2/2) moist; weak to moderate, medium, granular structure; soft, very friable; 20 percent small angular gravel; pH 6.8; gradual, smooth boundary.

B2t—8 to 16 inches, dark-brown (7.5YR 4/3) gravelly sandy clay loam, dark brown (7.5YR 3/3) moist; moderate, medium, subangular blocky structure parting to moderate, fine, subangular blocky; hard, friable; thin continuous clay films on ped faces; 30 percent fine angular gravel; pH 6.6; clear, wavy boundary.

R—16 inches, hard, unweathered granite.

The A horizon is typically gravelly sandy loam, but ranges to gravelly loam. It is 6 to 12 inches thick and ranges from very dark grayish brown to dark brown. The B2t horizon ranges from brown to dark brown. The content of small angular gravel is 15 to 35 percent. Depth to bedrock ranges from 10 to 20 inches.

Carbol very rocky sandy loam, 15 to 60 percent slopes (CaF).—This mapping unit is mainly in the southern part of the survey area along Cebolla Creek and its tributaries. It is 65 percent Carbol gravelly sandy loam and 20 percent Rock outcrop. Rock outcrop is mostly on the steeper terrain. In some areas the Carbol soil is moderately eroded.

Included with this unit in mapping are small areas of Uinta and Tolvar soils on northern and eastern exposures, areas of Woosley soils, and Alluvial land on toe slopes and fans. Included soils make up less than 15 percent of the total acreage.

Most of the acreage is in native vegetation and is used for woodland and grazing. Deer and elk often feed on the sunny slopes during the winter. Runoff is medium, and the erosion hazard is moderate. Capability unit VIIs-2 nonirrigated; woodland group 1.

Cathedral Series

The Cathedral series consists of shallow, well-drained soils on uplands. Slopes are 5 to 35 percent. These soils formed in material derived in place from granite.

In a representative profile the surface layer is dark-brown gravelly sandy loam about 7 inches thick. Below this is 8 inches of brown very gravelly sandy loam. Granite is at a depth of 15 inches.

Cathedral soils are on westerly and southerly exposures at elevations of 7,500 to 9,500 feet. They receive about 15 inches of precipitation annually and have an average annual soil temperature of about 43° F. The vegetation is commonly winterfat, dryland sedge, fringed sage, slimstem muhly, and blue grama.

Permeability is rapid. Roots can penetrate to a depth of only 10 to 20 inches, and available water capacity is low.

These soils are used mostly for range. They also provide habitat for wildlife.

The Cathedral soils in this survey area are mapped only with Kezar soils.

Representative profile of Cathedral gravelly sandy loam, 5 to 35 percent slopes; SE1/4 sec. 20, T. 49 N., R. 3 E., Gunnison County:

A1—0 to 7 inches, dark-brown (7.5YR 4/3) gravelly sandy loam, dark brown (7.5YR 3/2) moist; weak, fine, granular structure parting to weak, very fine, granular; soft, very friable; 40 percent angular granite gravel; pH 6.6; clear, smooth boundary.

C—7 to 15 inches, brown (7.5YR 5/4) very gravelly sandy loam, dark brown (7.5YR 4/4) moist; weak, medium, subangular blocky structure parting to weak, fine, subangular blocky; slightly hard, friable; 80 percent gravel; pH 6.6; abrupt, smooth boundary.

R—15 inches, slightly weathered granite.

The A1 horizon is typically gravelly sandy loam, but ranges to gravelly loam. Depth to bedrock ranges from 10 to 20 inches. The content of coarse fragments ranges from 50 to 70 percent.

Cebolia Series

The Cebolia series consists of deep, well-drained soils on hillsides, benches, and mountainsides. Slopes are 5 to 30 percent. These soils formed in alluvium that was derived from sandstone and shale.

In a representative profile the surface layer is dark-gray loam about 10 inches thick. The subsurface layer is pinkish-gray loam about 5 inches thick. The subsoil is reddish-brown clay about 23 inches thick. The substratum to a depth of 60 inches is calcareous, light-brown clay.

Cebolia soils are at elevations of 9,000 to 10,200 feet. The average annual precipitation is 18 inches. The average annual soil temperature is 40° F. The average soil temperature in summer is 51°. The native vegetation is commonly Thurber fescue, nodding brome, mountain bluegrass, and silver sagebrush.

Permeability is slow. Roots can penetrate to a depth of 60 inches or more, and available water capacity is high.

These soils are important for range and provide habitat for wildlife.

Representative profile of Cebolia loam, 5 to 30 percent slopes; SE1/4 sec. 30, T. 47 N., R. 2 E., Saguache County:

A1—0 to 10 inches, dark-gray (10YR 4/1) loam, black (10YR 2/1) moist; strong, fine and very fine, granular structure; soft, very friable; pH 6.6; clear, smooth boundary.

A2—10 to 15 inches, pinkish-gray (7.5YR 6/2) loam, brown (7.5YR 5/2) moist; strong, very fine, subangular blocky structure; soft, very friable; pH 6.6; abrupt, smooth boundary.

B2t—15 to 30 inches, reddish-brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; weak, medium, prismatic structure parting to strong, medium, angular blocky; extremely hard, firm; 5 percent gravel; pH 6.6; clear, smooth boundary.

B3—30 to 38 inches, reddish-brown (5YR 5/4) light clay, reddish brown (5YR 4/4) moist; moderate, medium, angular blocky structure; extremely hard, firm; 5 percent gravel; noncalcareous to weakly calcareous in places; pH 7.8; clear, smooth boundary.

Cca—38 to 60 inches, light-brown (7.5YR 6/4) light clay, brown (7.5YR 5/4) moist; massive; extremely hard, firm; 5 percent gravel; calcareous; few large concretions 1 to 2 inches in diameter; pH 8.0.

The A1 horizon is typically loam, but in places is stony

loam. The A2 horizon ranges from pinkish gray to gray. The B2t horizon is reddish brown to brown and ranges from clay to heavy clay loam. The content of coarse fragments ranges from less than 5 to 30 percent.

Cebolia loam, 5 to 30 percent slopes (CeE).—This soil occurs throughout the survey area. Large areas are near Huntsman Mesa and Mergelman Cow Camp.

Included with this soil in mapping are small areas of timbered Bead soils, areas of soils that have sandstone at a depth of 20 to 40 inches but are otherwise similar to Cebolia soils, and areas of Rock outcrop commonly in the steeper parts of the mapping unit. Included soils make up about 10 percent of the total acreage.

Essentially all the acreage is in native vegetation that is used for grazing in summer and early in fall and provides habitat for deer and elk. Runoff is medium to rapid, depending on slope. Erosion is a moderate hazard. Capability unit VIe-4 nonirrigated; Subalpine Loam range site.

Cheadle Series

The Cheadle series consists of shallow, excessively drained gravelly soils on upland ridges and valley sides. Slopes are 5 to 45 percent. These soils formed in material derived in place from gneiss or schist.

In a representative profile the surface layer is brown gravelly sandy loam about 9 inches thick. Below this is 8 inches of brown stony loam. Bedrock is at a depth of 17 inches.

Cheadle soils are at elevations of 7,500 to 9,000 feet. The climate is cool. The average annual soil temperature is less than 47° F., and the average soil temperature in summer is less than 58°. The average annual precipitation is 14 to 17 inches. The native vegetation is commonly big sagebrush, fringed sage, phlox, winterfat, squirreltail, and western wheatgrass.

Permeability is moderate. The root zone is 8 to 20 inches deep. Available water capacity to a depth of 17 inches is low.

These soils are used for range and provide habitat for wildlife.

The Cheadle soils in this survey area are mapped only with Lucky soils.

Representative profile of Cheadle gravelly sandy loam; sec. 34, T. 48 N., R. 2 E., Saguache County:

A1—0 to 9 inches, brown (10YR 4/3) gravelly sandy loam, dark brown (10YR 3/3) moist; moderate, medium, granular structure parting to moderate, fine, granular; soft, very friable; about 30 percent angular gravel; pH 7.6; clear, wavy boundary.

Cca—9 to 17 inches, brown (10YR 5/3) stony loam, brown (10YR 4/3) moist; massive; slightly hard, friable; about 40 percent angular coarse fragments, mostly gneiss; calcareous; some lime coats on coarse fragments; pH 8.4; abrupt, irregular boundary.

R—17 inches, gneiss.

The A1 horizon is dark-brown or very dark brown gravelly sandy loam 6 to 12 inches thick. Depth to bedrock ranges from 8 to 20 inches. Calcareous material is commonly below a depth of 10 inches. In some areas no lime has accumulated. The content of coarse fragments typically ranges from 35 to 50 percent.

Cochetopa Series

The Cochetopa series consists of deep, well-drained soils on uplands. Slopes are 5 to 30 percent. These soils formed in colluvial and alluvial material that was derived from basalt.

In a representative profile the surface layer is dark-gray loam about 4 inches thick. The subsoil is dark-gray light clay loam and very dark grayish-brown and brown gravelly clay and sandy clay about 41 inches thick. The substratum to a depth of 60 inches is light-brown stony clay loam.

Cochetopa soils are at elevations of 9,000 to 10,000 feet. The climate is cold, and the average annual soil temperature is about 39° F. The annual precipitation is about 18 inches.

Permeability is slow. Roots can penetrate to a depth of 60 inches or more, and available water capacity is high.

Almost all the acreage is used for range. A few small areas are used for irrigated hay and pasture.

Representative profile of Cochetopa loam, 5 to 30 percent slopes; sec. 22, T. 15 S., R. 86 W., Gunnison County:

A1—0 to 4 inches, dark-gray (10YR 4/1) loam, black (10YR 2/1) moist; moderate, very fine, granular structure; soft, very friable; about 10 percent angular coarse fragments; pH 6.8; clear, smooth boundary.

B1—4 to 12 inches, dark-gray (10YR 4/1) light clay loam, black (10YR 2/1) moist; moderate, fine, subangular blocky structure parting to moderate, fine, granular; slightly hard, friable; 10 percent angular coarse fragments; pH 6.8; clear, smooth boundary.

B21t—12 to 18 inches, very dark grayish-brown (10YR 3/2) gravelly clay, very dark brown (10YR 2/2) moist; strong, medium to fine, subangular blocky structure; very hard, firm, thin, continuous clay films on ped faces; 15 percent angular coarse fragments; pH 6.8; clear, smooth boundary.

B22t—18 to 32 inches, brown (7.5YR 5/4) gravelly clay, dark brown (7.5YR 4/4) moist; strong, medium, angular blocky structure parting to strong, fine, angular blocky; very hard, firm; thin continuous clay films; 15 percent coarse fragments; pH 7.2; gradual, smooth boundary.

B3—32 to 45 inches, brown (7.5YR 5/4) sandy clay, dark brown (7.5YR 4/4) when moist; 10 percent angular coarse fragments; moderate, fine to medium, subangular blocky structure; very hard when dry, firm when moist; thin patchy clay films on ped faces; pH 7.6; gradual, smooth boundary.

C—45 to 60 inches, light brown (7.5YR 6/4) stony clay loam, brown (7.5YR 5/4) when moist; massive; hard when dry, friable when moist; 30 percent coarse fragments; pH 7.6.

The A1 horizon is typically loam, but in places is gravelly and stony loam. It ranges from dark gray to dark brown. The content of coarse fragments generally ranges from 5 to 20 percent in the upper part of the profile, but is as high as 35 percent in the C horizon.

Cochetopa loam, 5 to 30 percent slopes (CoE).—This soil is mainly in the Crested Butte-Almont part of the survey area. At the higher elevations the surface layer is 12 to 20 inches thick.

Included with this soil in mapping are some areas where slopes are more than 30 percent and others where they are less than 5 percent; small areas of Youman and Passar soils; and some areas where this Cochetopa soil is underlain by sandstone and has a redder subsoil than the one described in the representative profile.

Included soils make up about 10 percent of the total acreage.

Nearly all the acreage is native range and is used for grazing in summer and fall. Runoff is medium to rapid, depending on slope. The erosion hazard is moderate. Capability units VIe-1 irrigated, VIe-4 nonirrigated; Subalpine Loam range site.

Corpening Series

The Corpening series consists of shallow, well-drained soils on upland hills, ridges, and benches. Slopes are 5 to 40 percent. These soils formed in material derived in place from calcareous sandstone or limestone.

In a representative profile the surface layer is brown fine sandy loam about 7 inches thick. Below this is about 7 inches of calcareous, pink gravelly sandy loam. Calcareous sandstone is at a depth of 14 inches.

Corpening soils are at an elevation of about 8,400 feet. The average annual soil temperature is 42° F., and the annual precipitation is 14 inches. The native vegetation is commonly fringed sage, cactus, winterfat, blue grama, and big sagebrush.

Permeability is moderately rapid. Roots can penetrate to a depth of only about 14 inches, and available water capacity is low.

These soils are used for range and provide habitat for wildlife.

Representative profile of Corpening fine sandy loam, 5 to 40 percent slopes; sec. 26, T. 48 N., R. 2 E., Saguache County:

A1—0 to 7 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 3/2) moist; weak, medium, platy structure parting to moderate, medium, granular; soft, very friable; 1 percent angular coarse fragments; pH 7.8; clear, smooth boundary.

Cca—7 to 14 inches, pink (7.5YR 7/4) gravelly sandy loam, light brown (7.5YR 6/4) moist; massive; slightly hard, very friable; calcareous; pH 8.0; 20 percent angular coarse fragments; clear, wavy boundary.

R—14 inches, slightly weathered, calcareous sandstone.

The A horizon is fine sandy loam, loam, or sandy loam that commonly is up to 20 percent coarse fragments. It ranges from dark grayish brown to brown. The depth to partly weathered calcareous sandstone or limestone ranges from 10 to 20 inches.

The Corpening soils in the survey area contain less clay than is typical for the Corpening soils mapped in other parts of Colorado. Use and management of the soils, however, are similar.

Corpening fine sandy loam, 5 to 40 percent slopes (CrE).—This soil is south of Powderhorn in the vicinity of Iron Hill.

Included with this soil in mapping are small eroded areas of Corpening fine sandy loam and small areas of Rock outcrop, Alluvial land, and Alluvial land, wet. Included soils make up about 10 percent of the total acreage.

This soil is best suited to range and wildlife. Runoff is medium to rapid, and the erosion hazard is moderate. Capability unit VIIs-1 nonirrigated; Dry Mountain Loam range site.

Curecanti Series

The Curecanti series consists of deep, well-drained soils on alluvial fans. These soils formed in cobbly loamy alluvium. Slopes are 1 to 8 percent.

In a representative profile the surface layer is brown gravelly loam about 7 inches thick. The subsoil is brown very cobbly sandy clay loam about 12 inches thick. The substratum to a depth of 60 inches is light-brown very cobbly loam.

Curecanti soils are at elevations of 7,700 to 8,500 feet. They receive about 18 inches of annual precipitation. The average annual soil temperature is about 42° F. The native vegetation is commonly black sagebrush, winterfat, phlox, squirreltail, and blue grama.

Permeability is moderate. Roots can penetrate to a depth of 60 inches or more, but available water capacity is low.

Curecanti soils are used for range and hay and provide habitat for wildlife.

Representative profile of Curecanti gravelly loam, 1 to 8 percent slopes; NE1/4 sec. 20, T. 48 N., R. 4 E., Saguache County:

A1—0 to 7 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; weak, fine, granular structure; slightly hard, very friable; about 15 percent gravel; pH 7.0; clear, smooth boundary.

B2t—7 to 14 inches, brown (7.5YR 5/3) very cobbly sandy clay loam, dark brown (7.5YR 4/3) moist; weak, medium, subangular blocky structure; hard, firm; clay films on ped faces; about 50 percent gravel and cobblestones; pH 6.8; clear, smooth boundary.

B3t—14 to 19 inches, brown (7.5YR 5/3) very cobbly sandy clay loam, dark brown (7.5YR 4/3) moist; weak, coarse to medium, subangular blocky structure; hard, firm; very few patchy clay films on ped faces; about 60 percent gravel and cobblestones; gradual boundary.

C—19 to 60 inches +, light-brown (7.5YR 6/3) very cobbly sandy loam, brown (7.5YR 4.5/3) moist; massive; very hard, friable; 60 percent cobblestones and gravel; pH 7.0.

The A horizon is typically gravelly loam, but in places is cobbly loam and gravelly sandy loam. It is 6 to 10 inches thick and is brown to dark brown. The content of cobblestones and gravel in the A horizon ranges from 15 to 40 percent. The B horizon is 8 to 14 inches thick. The Bt horizon is dominantly very cobbly sandy clay loam. The content of gravel and cobblestones in the B2t horizon ranges from 35 to 70 percent.

Curecanti gravelly loam, 1 to 8 percent slopes (CuB).—This soil is on terraces and outwash fans along major streams and side drainageways throughout the survey area. In many irrigated areas, it has a 1- to 2-inch organic mat.

Included with this soil in mapping in irrigated areas are patches of Evanston soils. Also included are small areas of Fola soils on terrace edges and steep terrace faces. Included soils make up less than 10 percent of the total acreage.

About half the acreage is used for irrigated hay and pasture. The rest is used for range. Runoff is medium, and the erosion hazard is slight. Capability units VIs-1 irrigated, VIe-2 nonirrigated; Mountain Outwash range site.

Dewville Series

The Dewville series consists of deep, well-drained soils on recent alluvial fans and valley-fill slopes. Slopes are 1 to 15 percent. These soils formed in mixed alluvium that was derived from sandstone, rhyolite, and rhyolitic tuff.

In a representative profile the surface layer is grayish-brown loam 10 inches thick. The subsoil is brown sandy clay loam about 12 inches thick. The substratum to a depth of 60 inches is grayish-brown and very pale brown sandy loam. It is calcareous below a depth of 22 inches.

Dewville soils are at elevations of about 9,000 to 10,000 feet. The average annual soil temperature is 40° F. The average annual precipitation is 15 inches. The native vegetation is commonly big sagebrush, needle-and-thread, Arizona fescue, and Indian ricegrass.

Permeability is moderate. Roots can penetrate to a depth of 60 inches or more. Available water capacity is moderate.

These soils are used mostly for irrigated hay and pasture.

Representative profile of Dewville loam, 5 to 15 percent slopes, 1½ miles west of Parlin; sec. 15, T. 49 N., R. 2 E., Gunnison County:

O1—1 inch to 0, partly decomposed organic material.
A1—0 to 10 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate, medium and fine, granular structure; slightly hard, very friable; pH 6.8; clear, wavy boundary.
B2—10 to 22 inches, brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate, medium and fine, subangular blocky structure; slightly hard, friable; 5 percent angular gravel; pH 7.2; gradual, smooth boundary.
C1ca—22 to 45 inches, grayish-brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable; 5 percent rock fragments; calcareous; pH 8.2; clear, wavy boundary.
C2ca—45 to 60 inches, very pale brown (10YR 7/4) sandy loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable; 5 percent rock fragments; calcareous; pH 8.2; gradual, wavy boundary.

The A horizon is typically loam, but in places is sandy loam, gravelly loam, and gravelly sandy loam. It is 7 to 12 inches thick and is grayish brown to dark brown. The amount of stratification varies within the profile. The content of rock fragments, mainly gravel, ranges from 0 to 15 percent throughout the profile.

Dewville loam, 1 to 5 percent slopes (DeB).—This soil occurs throughout the survey area on recent small fans and valley-fill slopes and in places on older terraces. Areas are irregular and in many places roughly triangular. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Corpening and Hopkins soils and areas of Curecanti and Bosler soils along the edges of old terraces and steep cobbly terraces. Also included, near the confluence of Gold Basin Creek and Tomichi Creek, is a strongly alkaline Dewville soil that is stratified below a depth of 22 inches. Included soils make up less than 10 percent of the total acreage.

Most of the acreage is used for irrigated hay and pasture. The rest is used for range and wildlife. Runoff is slow to medium. The erosion hazard is slight in areas under permanent vegetation. It is moderate during snowmelt. Capability units Vc-1 irrigated, VIe-2 nonirrigated; Mountain Outwash range site.

Dewville loam, 5 to 15 percent slopes (DeC).—This soil is on fans and valley-fill slopes. It is at higher elevations than Dewville loam, 1 to 5 percent slopes.

Included with this soil in mapping are areas of Corpening and Hopkins soils and Rock outcrop. Also included are wet areas and saline spots, which are identified by spot symbols on the soil map. Included soils make up less than 10 percent of the total acreage.

Most of the acreage is used for irrigated hay and pasture. Small areas are used for range. Runoff is medium to rapid, and the erosion hazard is moderate. Shallow gullies are common. Capability units VIe-1 irrigated, VIe-2 nonirrigated; Mountain Outwash range site.

Dollard Series

The Dollard series consists of moderately deep, well-drained soils on upland hills and ridges. Slopes are 5 to 30 percent. These soils formed in material derived in place from calcareous silty shale.

In a representative profile the surface layer is light olive-brown, calcareous silty clay loam about 6 inches thick. The next layer is light olive-brown, moderately calcareous silty clay about 4 inches thick. The underlying material is light yellowish-brown, strongly calcareous silty clay. Calcareous silty shale is at a depth of 20 to 40 inches.

Dollard soils are at an elevation of about 8,600 feet. The average annual soil temperature is 45° F. The average annual precipitation is about 16 inches. The native vegetation is chiefly western wheatgrass, muttongrass, and needlegrass. Big sagebrush is the principal shrub.

Permeability is slow. The root zone is only 20 to 40 inches deep, and available water capacity is low.

These soils are used mainly for grazing. Small acreages are used for irrigated hay and pasture.

Representative profile of Dollard silty clay loam, 5 to 30 percent slopes; sec. 14, T. 51 N., R. 1 W., Gunnison County:

A1—0 to 6 inches, light olive-brown (2.5YR 5/3) silty clay loam, olive brown (2.5Y 4/3) moist; weak, medium, platy structure parting to moderate, fine, granular; soft, firm; calcareous; pH 8.2; clear, smooth boundary.
AC—6 to 10 inches, light olive-brown (2.5Y 5/3) silty clay, olive brown (2.5Y 4/4) moist; weak, coarse, subangular blocky structure; hard, firm; numerous shiny pressure faces; few shale fragments; moderately calcareous; pH 8.4; gradual, wavy boundary.
Cca—10 to 25 inches, light yellowish-brown (2.5Y 6/4) silty clay, light olive brown (2.5Y 5/4) moist; massive; very hard, extremely firm; few shale fragments; strongly calcareous; many, medium to coarse, white (5Y 8/2) soft lime masses; pH 8.4; clear, wavy boundary.
R—25 inches, silty calcareous shale.

The A horizon is typically silty clay loam, but in places is silt brown and silty clay. It ranges from light olive brown to brown. Depth to calcareous shale ranges from 20 to 40 inches.

Dollard silty clay loam, 5 to 30 percent slopes (DoE).—This soil is mainly in the areas drained by Ohio and Razor Creeks. This soil has the profile described as representative of the series, but in small eroded areas the surface layer is thinner and lighter colored. Gullies have formed in the steeper areas.

Included with this soil in mapping are areas of Rock outcrop and areas where slopes are more than 30 per-

cent. Leaps and Morop soils make up about 10 percent of some mapped areas.

This soil is used mostly for grazing. Small areas are used for irrigated hay and pasture. Runoff is medium to rapid, and the erosion hazard is slight to moderate. Capability units VIe-1 irrigated, VIIe-1 nonirrigated; Deep Clay Loam range site.

Duffson Series

The Duffson series consists of moderately deep, well-drained, calcareous soils on hills, ridges, and benches. Slopes are 5 to 40 percent. These soils formed in locally transported alluvium that was derived from calcareous, interbedded sandstone and shale.

In a representative profile the surface layer is grayish-brown loam about 5 inches thick. The subsoil is brown and light yellowish-brown loam and clay loam about 15 inches thick. It is calcareous in the lower part. The substratum is about 10 inches of strongly calcareous, white loam. Below this is sandstone bedrock.

Duffson soils are at elevations of 7,500 to 9,500 feet. The average annual soil temperature is 45° F. The average soil temperature in summer is 62°. The average annual precipitation is 17 inches. The vegetation is commonly big sagebrush, Arizona fescue, wheatgrass, and native bluegrass.

Permeability is moderately slow. The root zone is only 20 to 40 inches deep, and available water capacity is low.

Most of the acreage is used for grazing.

The Duffson soils in the Gunnison Area are mapped only with Corpening and Spring Creek soils.

Representative profile of Duffson loam, 5 to 35 percent slopes; NW1/4 sec. 35, T. 48 N., R. 2 E., Saguache County:

A1—0 to 5 inches, grayish-brown (10YR 5/2) light loam, very dark grayish brown (10YR 3/2) moist; moderate, very fine, granular structure; soft, very friable; 10 percent fine sandstone gravel; pH 6.8; clear, smooth boundary.

B1t—5 to 8 inches, brown (7.5YR 5/3) clay loam, dark brown (7.5YR 3/3) moist; weak, medium, subangular blocky structure parting to moderate, very fine, subangular blocky; slightly hard, very friable; thin patchy clay films on ped faces; about 10 percent fine sandstone gravel; pH 6.8; clear, smooth boundary.

B2t—8 to 16 inches, brown (7.5YR 5/3) clay loam, dark brown (7.5YR 4/3) moist; weak, medium, prismatic structure parting to moderate, medium, subangular blocky; hard, friable; thin nearly continuous clay films on ped faces; about 10 percent angular sandstone gravel; pH 7.0; clear, wavy boundary.

B3tca—16 to 20 inches, light yellowish-brown (10YR 6/4) heavy loam, yellowish brown (10YR 5/4) moist; weak, medium, subangular blocky structure; hard, friable; few, thin, patchy clay films on ped faces; 10 percent angular sandstone gravel; lime in fine seams and small concretions; pH 8.0; gradual, wavy boundary.

Cca—20 to 30 inches, white (10YR 8/2) loam, light gray (10YR 7/2) moist; massive; hard, friable; about 10 percent sandstone gravel; calcareous; marl-like lime coatings on stone fragments; pH 8.2; clear, smooth boundary.

R—30 inches, sandstone.

The A horizon is typically loam, but in places is fine sandy loam. It is 4 to 9 inches thick and is grayish brown or brown. Depth to bedrock ranges from 20 to 40 inches. The content of gravel ranges from 5 to 15 percent.

Duffson-Corpening loams, 5 to 35 percent slopes (DrE).—This mapping unit is mainly in the central part of the survey area. The largest acreage is between Razor and Cochetopa Creeks. The unit is about 50 percent Duffson loam and 30 percent Corpening loam. The Duffson soil is generally on northern and eastern exposures. The Corpening soil is commonly on windswept, southern and western exposures. In some eroded areas of these soils, the surface layer is thinner and stonier than that in the profiles described as representative of the series.

Included with these soils in mapping are small areas of Lucky and Parlin soils, areas of severely eroded Duffson and Corpening soils, and areas of Rock outcrop and Stony rock land. Also included are areas of Alluvial land and Alluvial land, wet, commonly along small drainageways and toe slopes. Included soils make up less than 20 percent of the total acreage.

This unit is almost entirely in range. Runoff is medium. The erosion hazard is moderate unless a good plant cover is maintained. Capability unit VIe-5 nonirrigated; Duffson soil in Mountain Loam range site, Corpening soil in Dry Mountain Loam range site.

Duffson-Spring Creek stony loams, 5 to 40 percent slopes (DsE).—This mapping unit is mainly in the north-central part of the survey area. It is about 65 percent Duffson stony loam and 20 percent Spring Creek stony loam. The Duffson soil is mainly on northern exposures. At the higher elevations it has a surface layer 10 to 20 inches thick. The Spring Creek soil is on windswept, southern and western exposures. It has the profile described as representative of the Spring Creek series. Slopes are complex.

Included with these soils in mapping are small areas of Mord and Parlin soils and areas of Alluvial land and Alluvial land, wet, along minor drainageways in narrow, winding valleys. Also included are areas of Rock outcrop and Stony rock land on the steeper slopes and a few small sandy areas of wind-deposited material on north-facing slopes near Gunnison. Included soils make up 15 percent of the total acreage.

Nearly all the acreage is in native vegetation and is used for range, recreation, and wildlife. Runoff is medium to rapid, and the erosion hazard is moderate to high. About half the acreage, particularly where vegetation is sparse, has been eroded by wind and water. In these areas the surface layer is thinner and stonier than is typical. In some areas up to 3 acres in size, the Spring Creek soil has been so severely eroded that bedrock is exposed. Capability unit VIIs-1 nonirrigated; Duffson soil in Mountain Loam range site, Spring Creek soil in Dry Mountain Loam range site.

Evanston Series

The Evanston series consists of deep, well-drained soils on alluvial fans and valley-fill slopes. Slopes are 1 to 20 percent. These soils formed in alluvium that was derived from sandstone, rhyolite, and tuff.

In a representative profile the surface layer is dark-brown loam about 6 inches thick. The subsoil is brown clay loam and loam about 12 inches thick. It is calcare-

ous in the lower 4 inches. The substratum is strongly calcareous, light-brown loam that extends to a depth of 60 inches.

Evanston soils are at elevations of about 8,000 to 10,000 feet. Summers are cool, and winters are cold. The average annual soil temperature is less than 45° F. The average annual precipitation is about 14 inches. The native vegetation is commonly Arizona fescue, mountain muhly, and needlegrass. Big sagebrush and rabbitbrush are the principal shrubs.

Permeability is slow. Roots can penetrate to a depth of 60 inches or more, and available water capacity is high.

Most of the acreage is used for irrigated native pasture and hay. Small areas are in native range that is used by both livestock and wildlife.

Typical profile of Evanston loam, 1 to 5 percent slopes, in a road cut; NE1/4 sec. 7, T. 46 N., R. 3 W., Gunnison County:

A1—0 to 6 inches, dark-brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; moderate, medium, granular structure; slightly hard, friable; pH 7.0; clear, wavy boundary.

B1t—6 to 9 inches, dark-brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; weak, medium, subangular blocky structure parting to moderate, fine, subangular blocky; hard, friable; thin patchy clay films on ped faces; pH 7.2; clear, smooth boundary.

B2t—9 to 14 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate, coarse, subangular blocky structure parting to moderate, medium to fine, subangular blocky; very hard, firm; thin continuous clay films on ped faces; pH 7.2; clear, wavy boundary.

B3ca—14 to 18 inches, brown (7.5YR 5/4) heavy loam, dark brown (7.5YR 4/4) moist; weak, medium, subangular blocky structure parting to weak, fine, subangular blocky; hard, friable; calcareous; pH 7.8; gradual, smooth boundary.

Cca—18 to 60 inches +, light-brown (7.5YR 6/4) loam, brown (7.5YR 5/4) moist; massive; hard, friable; 5 to 10 percent rounded and angular cobblestones; calcareous; calcium carbonate in few fine concretions and in thin seams and streaks; pH 8.4.

The A horizon is typically loam, but in places is gravelly loam and sandy loam. It ranges from 3 to 10 inches in thickness and from brown to dark brown in color. The B horizon ranges from brown to light brown. Depth to lime ranges from 12 to 20 inches. The content of gravel and cobblestones ranges from 0 to 15 percent.

Evanston loam, 1 to 5 percent slopes (EvB).—This soil is on alluvial fans and valley-fill slopes, mainly along Ohio and Tomichi Creeks and their tributaries. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Dewville and Curecanti soils and, along Ohio Creek and the East River, small areas of Fola soils and steep gravelly terrace edges. Also included are saline spots and wet areas, which are identified by spot symbols on the soil map. Included soils make up less than 10 percent of the total acreage.

Most of the acreage is irrigated and produces good yields of meadow hay and pasture. Runoff is medium to slow. The erosion hazard is slight in areas protected by a plant cover of hay or pasture, but it is moderate during snowmelt and in areas where vegetation is sparse. Capability units Vc-1 irrigated, VIe-2 nonirrigated; Mountain Outwash range site.

Evanston loam, 5 to 20 percent slopes (EvD).—This soil is on alluvial fans and valley sides throughout the central part of the survey area. It is commonly in areas at the outlets of streams and side drainageways.

Included with this soil in mapping are steep cobbly terrace edges and small areas of Dewville and Mergel soils and Alluvial land. Included soils make up 15 percent of the total acreage.

Most of the acreage is native range and is used for grazing. Yields of meadow hay are moderate to good where irrigation water is available. Runoff is medium to rapid. It accumulates on surrounding soils, concentrates in drainageways, and creates gullies. The erosion hazard is moderate. Capability units VIe-1 irrigated, VIe-2 nonirrigated; Mountain Outwash range site.

Fola Series

The Fola series consists of deep, well-drained soils on alluvial fans and terraces. Slopes are 1 to 8 percent. These soils formed in cobbly and sandy alluvium that was derived from a wide variety of rocks.

In a representative profile the surface layer is brown cobbly sandy loam about 6 inches thick. The subsoil is reddish-brown very cobbly sandy loam about 10 inches thick. The substratum to a depth of 60 inches is brown very cobbly sandy loam.

Fola soils are at an elevation about 8,200 feet. The average annual precipitation is about 14 inches. The average annual soil temperature is 42° F. The native vegetation is commonly big sagebrush, western wheatgrass, Arizona fescue, and native bluegrass.

Permeability is rapid. Roots can penetrate to a depth of 60 inches or more, but available water capacity is low.

Fola soils are important for irrigated hay and pasture.

Representative profile of Fola cobbly sandy loam in a road cut on the east side of Cement Creek; sec. 27, T. 14 S., R. 85 W., Gunnison County:

A1—0 to 6 inches, brown (7.5YR 5/2) cobbly sandy loam, dark brown (7.5YR 4/2) moist; weak, very fine, granular structure; soft, very friable; 30 percent gravel and cobblestones; pH 7.4; gradual, smooth boundary.

B2—6 to 16 inches, reddish-brown (5YR 5/3) very cobbly sandy loam, reddish brown (5YR 4/3) moist; moderate, medium, subangular blocky structure; slightly hard, very friable; small amount of gelatinous coatings on some coarse fragments; 60 percent cobblestones and gravel; pH 7.4; gradual, smooth boundary.

C—16 to 60 inches, brown (7.5YR 5/3) very cobbly sandy loam, dark brown (7.5YR 4/3) moist; massive; soft, very friable; 70 percent gravel and cobblestones; pH 7.6.

The A horizon is typically cobbly sandy loam, but in places is sandy loam, stony loam, and loam. It is 4 to 12 inches thick. The B and C horizons are 35 to 80 percent gravel and cobblestones.

Fola cobbly sandy loam, 1 to 8 percent slopes (FoB).—This soil is on stream terraces and alluvial fans throughout the survey area. In some areas it has a thin organic mat at the surface.

Included with this soil in mapping are small areas of Gateview cobbly loam and Curecanti gravelly loam.

Included soils make up less than 10 percent of the total acreage.

Much of the acreage is irrigated and is used mainly for hay and pasture. Runoff is slow, and the erosion hazard is none to slight. Capability units VIs-1 irrigated, VIe-2 nonirrigated; Mountain Outwash range site.

Gas Creek Series

The Gas Creek series consists of deep, poorly drained and somewhat poorly drained soils on flood plains and low terraces. Slopes are 0 to 5 percent. These soils formed in recent cobbly alluvium that was derived from mixed parent material.

Typically, these soils have a 3-inch mat of partly decomposed organic material at the surface. In a representative profile the surface layer is mottled very dark gray and dark-gray sandy loam and very cobbly loam about 15 inches thick. The underlying material to a depth of 60 inches is grayish-brown very cobbly sand.

Gas Creek soils are at elevations of 7,800 to 8,500 feet. The average annual soil temperature is 46° F. The average annual precipitation is approximately 12 inches. The vegetation is commonly timothy, redtop, tufted hairgrass, slender wheatgrass, sedges, and rushes.

Permeability is rapid. The water table is at the surface or within a depth of 36 inches during much of the growing season. Roots of water-tolerant plants can penetrate to a depth of about 60 inches or more.

These soils are used for meadow hay and pasture.

Representative profile of Gas Creek sandy loam, 0 to 1 percent slopes, south of Dos Rios homesites; NE1/4 sec. 15, T. 49 N., R. 1 W., Gunnison County:

O1—3 inches to 0, organic mat of decomposing sedges and fibrous roots; calcareous in most places.

A11g—0 to 7 inches, very dark gray (10YR 3/1) sandy loam, black (10YR 2/1) moist; common, fine, prominent, yellowish-red (5YR 4/6) mottles and few, medium, faint, dark-gray (5Y 4/1) mottles; weak, fine, granular structure; very friable; about 10 percent gravel; pH 6.8; clear, smooth boundary.

A12g—7 to 15 inches, dark-gray (10YR 4/1) very cobbly sandy loam, very dark gray (10YR 3/1) moist; many, fine, prominent, yellowish-red (5YR 4/6) mottles; weak, medium, subangular blocky structure; very friable; about 60 percent gravel and cobblestones; pH 6.8; gradual, smooth boundary.

IIcg—15 to 60 inches, grayish-brown (10YR 5/2) very cobbly sand, dark grayish brown (10YR 5/2) moist; single grained; loose; about 80 percent gravel and cobblestones; pH 7.0.

The O1 horizon ranges from 0 to 4 inches in thickness, but is typically about 2 inches thick. The A horizon is typically sandy loam, but in places is gravelly sandy loam. It ranges from very dark gray to dark grayish brown. The soil is dominantly noncalcareous, but in some areas the A1 horizon contains lime. Reaction ranges from neutral to mildly alkaline.

Gas Creek sandy loam, 0 to 1 percent slopes (GaA).—This soil is on flood plains and low terraces along major streams and side drainageways. It has the profile described as representative of the series. Most areas adjacent to creek channels are poorly drained. The water table is at the surface or within a depth of 18 inches, depending on the level of the adjacent creek flow. This soil is subject to occasional overflow during periods of runoff in spring. During periods of overflowing, sand and gravel are deposited on the surface.

Included with this soil in mapping are areas of Irim soils and areas of Alluvial land, occasionally flooded, adjacent to creek channels. Excessively wet areas are identified by spot symbols on the soil map. Included soils make up less than 15 percent of the total acreage.

All the acreage is irrigated and is used for native hay and pasture. Runoff is slow, and the erosion hazard is none or slight. Capability unit Vw-1 irrigated.

Gas Creek sandy loam, 1 to 5 percent slopes (GaB).—This soil is on flood plains along major streams and side drainageways. It is somewhat poorly drained. The water table fluctuates between depths of 18 and 36 inches. An organic mat 1 to 2 inches thick is at the surface in most areas.

Included with this soil in mapping are areas of Irim soils and areas of Big Blue soils in old slack water areas in oxbows and small depressions. Included soils make up less than 10 percent of the total acreage.

All the acreage is irrigated and is used for native hay. Runoff is slow or medium, and the erosion hazard is slight. Overflow is generally not a hazard. Capability unit VIs-1 irrigated.

Gateview Series

The Gateview series consists of deep, well-drained soils on terraces, alluvial fans, and till plains. Slopes are 2 to 30 percent. These soils formed in gravelly and cobbly alluvium and glacial till of mixed origin.

In a representative profile the surface layer is dark grayish-brown and grayish-brown cobbly loam and very gravelly sandy loam about 22 inches thick. The underlying material is brown very gravelly sandy loam. It extends to a depth of 60 inches or more.

Gateview soils are at elevations of 8,500 to 9,500 feet. The average annual soil temperature is 40° F., and the average annual precipitation is about 20 inches. The native vegetation is commonly Thurber fescue, native bluegrass, and big sagebrush.

Permeability is moderate. Roots can penetrate to a depth of more than 60 inches, but available water capacity is low.

The Gateview soils in the survey area are near Crested Butte. They are used mainly for range. Some areas are irrigated.

Representative profile of Gateview cobbly loam, 8 to 30 percent slopes, in a road cut about 2 miles south of Crested Butte; sec. 12, T. 14 S., R. 86 W., Gunnison County:

A11—0 to 10 inches, dark grayish-brown (10YR 4/2) cobbly loam, very dark brown (10YR 2/2) moist; moderate, medium, granular structure parting to moderate, fine, granular; slightly hard, very friable; about 25 percent cobblestones and gravel; pH 6.8; clear, smooth boundary.

A12—10 to 22 inches, grayish-brown (10YR 5/2) very gravelly sandy loam, very dark brown (10YR 2/2) moist; weak, very fine, granular structure; soft, very friable; 60 percent gravel and cobblestones; pH 6.8; gradual, smooth boundary.

C—22 to 60 inches, brown (10YR 5/3) very gravelly sandy loam, brown (10YR 4/3) moist; massive; slightly

hard, very friable; 60 percent gravel and cobblestones; pH 7.0.

The A11 horizon is typically cobbly loam, but in places is cobbly sandy loam. The A horizon ranges from 16 to 25 inches in thickness. The content of gravel and cobblestones below a depth of about 10 inches is 35 to 70 percent.

Gateview cobbly loam, 2 to 8 percent slopes (GeB).—This soil is mainly in the Crested Butte area on outwash fans. It has the profile described as representative of the series. In irrigated areas it has an organic mat 1 to 2 inches thick at the surface.

Included with this soil in mapping are small areas of Fola and Curecanti soils and small areas of Youman soils along margins of the uplands. Included soils make up about 10 percent of the total acreage.

Most of the acreage is irrigated and is used for hay and pasture. The rest is used for range. Runoff is slow. Erosion is a moderate hazard during periods of snowmelt, but is not a hazard in areas under irrigated pasture cover. Capability units VIs-1 irrigated, VIe-2 nonirrigated; Subalpine Loam range site.

Gateview cobbly loam, 8 to 30 percent slopes (GeE).—This soil is mainly in the Crested Butte area on glacial moraines and outwash fans. It has a profile similar to the one described as representative of the series, but in small eroded areas the surface layer is slightly lighter colored and thinner.

Included with this soil in mapping are areas that are up to 10 percent Youman and Passar soils and small areas of Curecanti and Fola soils along streams and terraces.

Nearly all the acreage is native range and is used for grazing. Some small areas are used for irrigated meadow hay and pasture. Runoff is medium, and the erosion hazard is moderate. Capability units VIe-1 irrigated, VIIs-1 nonirrigated; Subalpine Loam range site.

Gold Creek Series

The Gold Creek series consists of deep, poorly drained, alkali-affected soils on flood plains and low terraces. Slopes are 0 to 5 percent. These soils formed in recent alluvium that was derived from strongly alkaline silty shale.

Typically, these soils have a 2-inch mat of partly decomposed roots. In a representative profile the surface layer is about 20 inches of gray and dark-gray silty clay loam and silty clay that is mottled in the lowest part. The subsoil is mottled light-gray silty clay about 21 inches thick. The substratum to a depth of 60 inches is mottled very gravelly and cobbly sand.

Gold Creek soils are at elevations of about 7,800 to 8,200 feet. They receive approximately 12 inches of precipitation annually. The average annual soil temperature is 38° F. The native vegetation is saltgrass, greasewood, sedges, and rushes.

These soils have a fluctuating water table 1 foot to 2 feet below the surface during most of the growing season. Permeability is slow, and available water capacity is moderate. Roots can penetrate to a depth of 60 inches or more.

These soils are irrigated and used for pasture and hay.

Representative profile of Gold Creek silty clay loam, 0 to 5 percent slopes, west of Doyleville along Tomichi Creek; SW1/4 sec. 34, T. 49 N., R. 3 E., Gunnison County:

O1—2 inches to 0, organic mat of plant roots.

A11—0 to 9 inches, gray (10YR 5/1) silty clay loam, black (10YR 2/1) moist; moderate, fine, granular structure; very hard, firm; calcareous in spots; few, fine and medium, white (10YR 8/2) lime streaks; pH 9.2; gradual, wavy boundary.

A12g—9 to 20 inches, dark-gray (2.5Y 4/1) silty clay, black (10YR 2/1) moist; common, medium, distinct, olive-brown (2.5Y 4/6) mottles; weak, coarse, subangular blocky structure parting to moderate, fine, granular; very hard, firm; calcareous; 10 percent white (10YR 8/1) lime streaks; pH 9.5; gradual, wavy boundary.

B2g—20 to 41 inches, light-gray (10YR 7/2) silty clay, light brownish gray (10YR 6/2) moist; common, medium, distinct, olive-brown (2.5Y 4/6) mottles; massive; very hard, firm; calcareous; pH 9.6; abrupt, wavy boundary.

IIC—41 to 60 inches, strongly mottled very gravelly and cobbly sand; single grained; loose; pH 9.0.

The O1 horizon is typically 1 to 4 inches thick. In localized areas, no O1 horizon is evident. The A horizon is dominantly silty clay loam, but in places is light clay or clay loam. It ranges from dark gray to grayish brown. Depth to the IIC horizon ranges from 40 to 60 inches or more. Reaction ranges from stongly alkaline to vey strongly alkaline.

Gold Creek silty clay loam, 0 to 5 percent slopes (GrB).—This soil is on flood plains and low terraces along major streams and side drainageways in the eastern part of the survey area. It is often saturated during periods of high water.

Included with this soil in mapping are areas of Big Blue soils in old slack water areas and oxbows, small areas of Dewville soils on small fans, and areas of Irim and Gas Creek soils 1 to 3 acres in size. Slickspots are common throughout the area. Included soils make up less than 15 percent of the total acreage.

All the acreage is irrigated and used for hay and pasture. Runoff is slow, and the erosion hazard is none to slight. Capability unit Vw-3 irrigated.

Hopkins Series

The Hopkins series consists of deep, well-drained soils on upland hills, ridges, and valley sides. Slopes are 5 to 45 percent. These soils formed in channery material weathered from rhyolite and tuff.

In a representative profile the surface layer is dark grayish-brown channery loam about 12 inches thick. The underlying material is about 4 inches of light brownish-gray channery loam grading to overlapping flagstones of rhyolite that extends to a depth of 60 inches.

Hopkins soils are at elevations of about 7,700 to 9,000 feet. The average annual soil temperature is about 45°F., and the average annual precipitation is about 14 inches. The native vegetation is commonly fringed sage, winterfat, phlox, western wheatgrass, blue grama, squirreltail, dryland sedges, and slimstem muhly.

Permeability is moderate. Roots can penetrate to a depth of only about 16 inches, and available water capacity is low.

These soils are used mainly for range and wildlife.

The Hopkins soils in this survey area are mapped only with Parlin soils.

Representative profile of Hopkins channery loam, 5 to 45 percent slopes; SE1/4 sec. 27, T. 49 N., R. 2 E., Gunnison County:

A1—0 to 12 inches, dark grayish-brown (10YR 4/2) channery loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, granular structure parting to moderate, fine, granular; soft, very friable; about 20 percent channery fragments; pH 7.6; gradual, wavy boundary.

C1—12 to 16 inches, light brownish-gray (10YR 6/2) channery loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable; about 20 percent coarse channery fragments; calcareous; pH 8.2; gradual, wavy boundary.

IIC2—16 to 60 inches, overlapping rhyolite flagstone, separated by unfilled, ½- to 4-inch voids.

The A horizon is typically channery loam, but in places is channery sandy loam. It ranges from 5 to 15 inches in thickness and from dark grayish brown to grayish brown in color. The C horizon is typically calcareous, but in places is free of lime. The content of channery material in the A and C horizons ranges from 10 to 35 percent. Depth to the open-lattice flagstone is 8 to 20 inches.

Irim Series

The Irim series consists of deep, poorly drained soils on flood plains. Slopes are 0 to 5 percent. These soils formed in recent alluvium of mixed origin.

Typically, these soils have a 2-inch mat of partly decomposed organic material. In a representative profile the surface layer is dark-gray loam about 11 inches thick. The subsoil extends to a depth of 60 inches. It is mottled grayish-brown very gravelly loam.

Irim soils are at elevations of about 7,800 to 8,500 feet. The climate is cold in winter and cool in summer. The average annual soil temperature is 42°F. The average annual precipitation is about 15 inches. The vegetation is commonly timothy, redtop, tufted hairgrass, slender wheatgrass, rushes, and sedges.

These soils have a water table within 36 inches of the surface during much of the growing season. Permeability is moderate. Roots can penetrate to a depth of 60 inches or more, but available water capacity is low.

These soils are important for production of native hay and pasture.

Representative profile of Irim loam, 0 to 1 percent slopes, 1 mile west of Doyleville along Tomichi Creek; SW1/4 sec. 34, T. 49 N., R. 3 E., Gunnison County:

O1—2 inches to 0, organic mat of roots.

A1g—0 to 11 inches, dark-gray (10YR 4/1) loam, black (10YR 2/1) moist; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; hard, friable; about 10 percent gravel; pH 7.0; gradual, wavy boundary.

B21g—11 to 22 inches, grayish-brown (10YR 5/2) very gravelly loam, dark grayish brown (10YR 4/2) moist; common, medium, prominent, light olive-brown (2.5Y 5/6) mottles; massive; hard, friable; 50 percent gravel; pH 7.0; clear, wavy boundary.

B22g—22 to 60 inches, grayish-brown (10YR 5/2) very gravelly loam, dark grayish brown (10YR 4/2) moist; common, medium, prominent, light olive-brown (2.5Y 5/6) mottles; massive; soft, very friable; pH 7.0.

The O1 horizon is typically 2 inches thick, but ranges from 1 to 4 inches. The A horizon is typically loam, but in places is heavy sandy loam and light clay loam. Below a depth of about 10 inches, this soil is 50 to 70 percent gravel and cobblestones.

Irim loam, 0 to 1 percent slopes (IrA).—This soil is on flood plains adjacent to major streams and side drainageways. It has the profile described as representative of the series. It has a fluctuating water table, the level of which depends on the water level in adjacent streams. In spring the water table is at or near the surface. Late in summer it drops to a depth of about 2 feet. Overflow and the deposition of silt, sand, or gravel are common. Water from overflow or irrigation is ponded in small depressions.

Included with this soil in mapping are small areas of Gas Creek and Big Blue soils and Alluvial land, occasionally flooded. Also included near Crested Butte are areas of peat and muck. Excessively wet areas are indicated by spot symbols on the soil map. Included soils make up about 15 percent of the total acreage.

All the acreage is irrigated and is used for hay. Runoff is very slow or ponded, and the erosion hazard is slight. Capability unit Vw-1 irrigated.

Irim loam, 1 to 5 percent slopes (IrB).—This soil is on flood plains along major streams. It is ordinarily farther from the main stream channels than Irim loam, 0 to 1 percent slopes. It has a water table that fluctuates from near the surface for short periods to a depth of about 3 feet. It is subject to occasional overflow.

Included with this soil in mapping are small areas of Big Blue and Gas Creek soils and areas of peat and muck near Crested Butte. Included soils make up about 10 percent of the total acreage.

All the acreage is irrigated and produces moderate to good yields of native hay. Runoff is slow, and the erosion hazard is slight to moderate. Capability unit Vw-2 irrigated.

Jerry Series

The Jerry series consists of deep, well-drained soils on upland hills, ridges, and valley sides. Slopes are 5 to 30 percent. These soils formed in locally transported alluvium that was derived from sandstone and sandy shale.

In a representative profile the surface layer is dark-gray loam about 6 inches thick. The subsoil is gravelly heavy clay loam about 39 inches thick. It is dark grayish brown, brown, light brown, and pale brown. The substratum to a depth of 60 inches is pale-brown stony loam.

Jerry soils are at elevations of 8,900 to 10,000 feet. The average annual precipitation is about 20 inches, and the average annual soil temperature is about 38°F. The native vegetation is commonly big sagebrush, snowberry, Thurber fescue, Arizona fescue, nodding brome, native bluegrass, and scattered groves of aspen.

Permeability is slow, and available water capacity is moderate. Roots can penetrate to a depth of 60 inches or more.

These soils are used mainly for grazing and wildlife.

Representative profile of Jerry loam, 5 to 30 percent slopes, near the center of sec. 36, T. 15 S., R. 85 W., Gunnison County:

A1—0 to 6 inches, dark-gray (10YR 4/1) loam, black (10YR 2/1) moist; weak, thin, platy structure parting to moderate, medium, granular; soft, very friable; 10

percent angular gravel; pH 6.8; clear, wavy boundary.

B1t—6 to 11 inches, dark grayish-brown (10YR 4/2) heavy loam, very dark brown (10YR 2/2) moist; weak, medium, subangular blocky structure parting to moderate, medium, granular; slightly hard, friable; thin patchy clay films on ped faces; 10 percent angular gravel; pH 6.8; clear, wavy boundary.

B21t—11 to 24 inches, brown (7.5YR 5/3) gravelly heavy clay loam, dark brown (7.5YR 4/3) moist; weak, medium, prismatic structure parting to moderate to strong, medium, subangular blocky; very hard, firm; medium continuous clay films on ped faces; 20 percent angular gravel; pH 6.8; clear, wavy boundary.

B22t—24 to 35 inches, light-brown (7.5YR 6/4) gravelly heavy clay loam, dark brown (7.5YR 4/4) moist; moderate, medium, subangular blocky structure parting to moderate, fine, subangular blocky; very hard, firm; medium continuous clay films on ped faces; 25 percent angular gravel; pH 6.8; clear, wavy boundary.

B3tca—35 to 45 inches, pale-brown (10YR 6/3) gravelly clay loam, dark brown (10YR 4/3) moist; weak, medium, subangular blocky structure; hard, friable; thin patchy clay films on ped faces; 30 percent angular gravel; calcareous; pH 7.8; gradual, wavy boundary.

Cca—45 to 60 inches, pale-brown (10YR 6/3) stony loam, brown (10YR 5/3) moist; massive; hard, friable; 30 percent angular gravel and stones; calcareous; pH 8.2.

The A horizon ranges from loam to stony loam and is typically about 6 inches thick, but ranges from 4 to 8 inches. The B horizon is clay or heavy clay loam and is 35 to 45 prceent clay in some parts. The content of angular gravel and stone fragments in the solum ranges from 15 to 35 percent.

Jerry loam, 5 to 30 percent slopes (JeE).—This soil is mainly east of Powderhorn and in the Crested Butte area. Included in mapping are small areas of Duffson and Corpening soils and Jerry stony or very stony loam. Small areas of Rock outcrop are common. Included soils make up less than 10 percent of the total acreage.

Most of the acreage is in native vegetation and is used for grazing and wildlife. Runoff is medium, and the erosion hazard is moderate. Capability unit VIe-1 irrigated, VIe-4 nonirrigated; Subalpine Loam range site.

Kezar Series

The Kezar series consists of moderately deep, well-drained soils on hillsides, ridges, and mountainsides. Slopes are 5 to 35 percent. These soils are in the central part of the survey area. They formed in material weathered from granite.

In a representative profile the surface layer is brown gravelly sandy loam about 6 inches thick. The subsoil is brown gravelly sandy loam or gravelly sandy clay loam about 20 inches thick. Granite is at a depth of 26 inches.

Kezar soils are at elevations of 7,500 to 9,500 feet. The average annual precipitation is 15 inches, and the average annual soil temperature is about 44° F. The vegetation is commonly big sagebrush, Arizona fescue, western wheatgrass, and native bluegrass.

Permeability is moderate. Roots can penetrate to a depth of only about 24 inches, and available water capacity is low.

These soils are used mainly as range.

The Kezar soils in the Gunnison Area are mapped only with Cathedral soils.

Representative profile of Kezar gravelly sandy loam, 5 to 35 percent slopes; sec. 22, T. 49 N., R. 1 W., Gunnison County:

A1—0 to 6 inches, brown (7.5YR 4/3) gravelly sandy loam, dark brown (7.5YR 3/3) moist; weak, medium and coarse, granular structure parting to moderate, fine, granular; soft, very friable; 25 percent fine, angular, granitic gravel; pH 7.0; clear, smooth boundary.

B1t—6 to 10 inches, brown (7.5YR 5/3) gravelly heavy coarse sandy loam, dark brown (7.5YR 3/3) moist; weak, fine, subangular blocky structure parting to moderate, fine, granular; slightly hard, friable; few, thin, patchy clay films on ped faces; 25 percent angular granitic gravel; pH 7.0; clear, smooth boundary.

B2t—10 to 22 inches, brown (7.5YR 5/4) gravelly sandy clay loam, dark brown (7.5YR 4/4) moist; moderate, medium, subangular blocky structure parting to moderate, fine, subangular blocky; extremely hard, friable; thin continuous clay films on ped faces; 25 percent angular granitic gravel; pH 7.2; gradual, smooth boundary.

B3t—22 to 26 inches, brown (7.5YR 5/4) gravelly sandy clay loam, dark brown (7.5YR 4/4) moist; weak, medium, subangular blocky structure; extremely hard, friable; few, thin, patchy clay films on ped faces; 30 percent angular granitic gravel; pH 7.6; clear, wavy boundary.

R—26 inches, granite.

The A1 horizon is gravelly sandy loam or gravelly loam, is 4 to 9 inches thick, and is brown to dark brown. The B2t horizon is gravelly sandy clay loam or gravelly clay loam. The content of gravel in the A and B horizons ranges from 10 to 35 percent. Depth of granite ranges from 20 to 40 inches.

Kezar-Cathedral gravelly sandy loams, 5 to 35 percent slopes (KcE).—This mapping unit is on uplands in the central part of the survey area. It is approximately 55 percent Kezar gravelly sandy loam and 30 percent Cathedral gravelly sandy loam. The Kezar soil is commonly on northerly and easterly exposures. The Cathedral soil is commonly on windswept, southerly and westerly exposures. Each soil has the profile described as representative of its series.

Included with these soils in mapping are small areas of Lucky and Parlin soils and eroded Kezar and Cathedral soils. Also included are Rock outcrop and areas of Alluvial land along drainageways. Included soils make up less than 15 percent of the total acreage.

Almost all the acreage is range and is used for livestock grazing and wildlife. Runoff is medium, and the erosion hazard is moderate. Capability unit VIe-5 nonirrigated; Kezar soil in Mountain Loam range site, Cathedral soil in Dry Mountain Loam range site.

Kubler Series

The Kubler series consists of deep, well-drained soils on mountainsides. Slopes are 5 to 35 percent. These soils formed in material weathered from rhyolite and rhyolitic tuff.

In a representative profile the surface layer is dark-brown loam about 10 inches thick. The subsoil is brown and reddish-brown clay loam and gravelly clay about 37 inches thick. The substratum to a depth of 60 inches is reddish-brown gravelly clay loam.

Kubler soils are at elevations of 8,000 to 9,000 feet. They receive about 18 inches of annual precipitation. The average annual soil temperature is less than 44°F. The vegetation is commonly Thurber fescue, nodding brome, native bluegrass, big sagebrush, and scattered clumps of Gambel oak and aspen.

Permeability is slow, and available water capacity is moderate. Roots can penetrate to a depth of 60 inches or more.

These soils are used principally for grazing, recreation, and wildlife. Where water is available for irrigation, some of the less sloping areas are used for meadow hay and pasture.

Representative profile of Kubler loam, 5 to 35 percent slopes, three fourths of a mile south of Skyline Cafe; SE1/4 sec. 8, T. 48 N., R. 4 W., Gunnison County:

A1—0 to 10 inches, dark-brown (7.5YR 4/2) loam, very dark brown (7.5YR 2/2) moist; moderate, medium, granular structure; soft, very friable; 10 percent angular gravel; pH 6.8; clear, smooth boundary.

B1t—10 to 15 inches, brown (7.5YR 4/2) clay loam, very dark brown (7.5YR 2/2) moist; moderate, medium, subangular blocky structure parting to moderate, fine, subangular blocky; hard, firm; thin continuous clay films on both horizontal and vertical ped surfaces; 10 percent angular gravel; pH 6.8; clear, wavy boundary.

B2t—15 to 39 inches, reddish-brown (5YR 4/3) gravelly clay, dark reddish brown (5YR 3/3) moist; weak, coarse, prismatic structure parting to moderate and strong, medium and fine, angular blocky; extremely hard, very firm; moderate, medium, continuous clay films on ped faces; 15 percent angular gravel; pH 6.8; gradual, wavy boundary.

B3t—39 to 47 inches, reddish-brown (5YR 5/4) gravelly clay, reddish brown (5YR 4/4) moist; moderate, medium, angular blocky structure parting to moderate, fine, angular blocky; extremely hard, very firm; thin patchy clay films on ped faces; 25 percent angular gravel; pH 7.0; gradual, wavy boundary.

Cca—47 to 60 inches, reddish-brown (5YR 5/4) gravelly clay loam, reddish brown (5YR 4/4) moist; massive; hard, firm; 30 percent angular gravel; calcareous; pH 8.0.

The A horizon is typically loam, but in places is gravelly and stony. It ranges from dark grayish brown to brown in color and from 8 to 14 inches in thickness, but typically is 10 inches thick. The B horizon ranges from brown to reddish brown. The B2t horizon is clay loam or clay that is 10 to 35 percent gravel, cobblestones, or stones.

Kubler loam, 5 to 35 percent slopes (KuE).—This soil is in the west-central part of the survey area. On some southerly and westerly exposures, the surface layer is thinner than is typical and is gravelly or cobbly.

Included with this soil in mapping are areas, less than 5 acres in size, of Evanston soils on southerly and westerly exposures; small stony and very stony, rounded knobs and ridgetops where Rock outcrop is common; and scattered, small areas of Alluvial land, wet, along irregularly shaped drainageways. Included soils make up less than 15 percent of the total acreage.

Almost all the acreage is in native vegetation and is used for grazing, recreation, and wildlife. Small localized areas are used for irrigated meadow hay and pasture. Runoff is medium, and the erosion hazard is slight or moderate. Capability unit VIe-1 irrigated, VIe-4 nonirrigated; Subalpine Loam range site.

Leaps Series

The Leaps series consists of deep, well-drained soils on alluvial fans and valley-fill slopes. Slopes are 5 to 30 percent. These soils formed in material weathered from noncalcareous silty shale and other sedimentary rock.

In a representative profile the surface layer is grayish-brown silty clay loam about 10 inches thick. Beneath this and extending to a depth of 60 inches is grayish-brown and light olive-brown silty clay.

Leaps soils are at elevations of 8,000 to 9,800 feet. They receive approximately 20 inches of annual precipitation. The average annual soil temperature is less than 40°F. The native vegetation is commonly western wheatgrass, needlegrass, and big sagebrush.

Permeability is slow. Roots can penetrate to a depth of 40 to 60 inches or more, and available water capacity is high.

These soils are used for grazing, recreation, and wildlife.

Representative profile of Leaps silty clay loam, E1/2 sec. 17, T. 14 S., R. 85 W., Gunnison County:

A1—0 to 10 inches, grayish-brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate, fine, granular structure; hard, friable; pH 6.5; clear, wavy boundary.

AC—10 to 23 inches, grayish-brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate, medium, granular structure; very hard, firm; pH 6.0; gradual, smooth boundary.

C—23 to 60 inches, light olive-brown (2.5Y 6/4) silty clay, light olive brown (2.5Y 5/4) moist; massive; extremely hard, very firm; pH 6.0.

Loose stones are on the surface in localized areas. The A horizon is typically loam or silty clay loam, but in places is clay loam and silty clay. It ranges from 8 to 14 inches in thickness and from very dark grayish brown to grayish brown in color. The C horizon is silty clay or clay. It is typically noncalcareous, but contains some lime in localized areas. In some areas silty shale is at a depth of 40 to 60 inches.

Leaps silty clay loam, 5 to 30 percent slopes (LeE).—This soil is along Ohio Creek and its tributaries and in the Crested Butte area. It is commonly on northerly and easterly exposures. Small areas at higher elevations are on southerly exposures.

Included with this soil in mapping are 5- to 8-acre tracts of Dollard soils and small areas of Mord and Cochetopa soils. Included soils make up less than 15 percent of the total acreage.

Almost all the acreage is in native range and is used for livestock grazing and wildlife. Runoff is medium to rapid, and the erosion hazard is moderate. Small landslides are common on the steeper slopes. Capability unit VIIe-1 nonirrigated; Deep Clay Loam range site.

Lucky Series

The Lucky series consists of moderately deep, well-drained soils on mountainsides and ridges. Slopes are 5 to 45 percent. These soils formed in locally transported gravelly sediment that was derived from gneiss and schist. The underlying bedrock is mostly hard and resistant to weathering.

In a representative profile the surface layer is very dark grayish-brown gravelly sandy loam about 8 inches

thick. The subsoil is brown and yellowish-brown gravelly sandy loam and sandy clay loam about 20 inches thick. Gneiss is at a depth of 28 inches.

Lucky soils are at elevations of 7,500 to 9,000 feet. The average annual soil temperature is 42°F. The annual precipitation is about 18 inches. The native vegetation is commonly big sagebrush, Arizona fescue, wheatgrass, native bluegrass, and mountain muhly.

Permeability is moderate. Roots can penetrate to a depth of only about 2½ feet, and available water capacity is low.

These soils are used mainly as range. They also provide habitat for wildlife.

Representative profile of Lucky gravelly sandy loam in an area of Lucky-Cheadle gravelly sandy loams, 5 to 45 percent slopes; NE1/4 sec. 10, T. 48 N., R. 1 E., Gunnison County:

A1—0 to 8 inches, very dark grayish-brown (10YR 3/2) gravelly sandy loam, very dark brown (10YR 2/2) moist; moderate, fine, granular structure; soft, very friable; about 15 percent angular gravel; pH 6.6; clear, smooth boundary.

B1—8 to 12 inches, brown (10YR 5/3) gravelly heavy sandy loam, dark brown (10YR 3/3) moist; weak, medium, subangular blocky structure parting to moderate, fine, granular; slightly hard, very friable; about 10 percent angular gravel; pH 6.8; clear, smooth boundary.

B2t—12 to 22 inches, brown (7.5YR 5/4) gravelly sandy clay loam, brown (7.5YR 4/4) moist; moderate, medium, subangular blocky structure parting to moderate, fine, subangular blocky; hard, firm; thin continuous clay films on ped faces; about 20 percent angular gravel and cobblestones; pH 7.0; gradual, smooth boundary.

B3t—22 to 28 inches, yellowish-brown (10YR 5/4) gravelly light sandy clay loam, dark yellowish brown (7.5YR 4/4) moist; weak, medium, subangular blocky structure; slightly hard, friable; few, thin, patchy clay films on ped faces; about 25 percent angular gravel; pH 7.0; gradual, wavy boundary.

R—28 to 29 inches, gneiss.

The A horizon ranges from 7 to 12 inches in thickness and from grayish brown to very dark grayish brown in color. It is typically gravelly sandy loam, but in places is gravelly loam or loam. The B horizon ranges from 13 to 30 inches in thickness and from gravelly sandy clay loam to gravelly clay loam. The content of gravel and small angular cobblestones in the A and B horizons ranges from 10 to 35 percent. In some areas the B3 horizon is weakly calcareous. Depth to bedrock ranges from 20 to 40 inches.

Lucky-Cheadle gravelly sandy loams, 5 to 45 percent slopes (LhF).—This mapping unit is on uplands throughout the central part of the survey area. It is approximately 55 percent Lucky gravelly sandy loam and 30 percent Cheadle gravelly sandy loam. The Lucky soil is generally on northerly and easterly exposures, and the Cheadle soil is on windswept, southerly and westerly exposures. Each soil has the profile described as representative of its series. In eroded areas the surface layer is somewhat thinner and has more angular gravel and cobblestones than is typical.

Included with these soils in mapping are small areas of Parlin, Youman, and Duffson soils and small areas of Rock outcrop and Alluvial land. Also included are a few, small, scattered areas on old trails and near salt licks where the soil is severely eroded. Included soils make up less than 15 percent of the total acreage.

Almost all the acreage is range and is used for livestock and wildlife. Runoff is medium. The erosion hazard is slight if plant cover is adequate. It is moderate during snowmelt. Capability unit VIIe-3 nonirrigated; Lucky soil in Mountain Loam range site, Cheadle soil in Dry Mountain Loam range site.

Meredith Series

The Meredith series consists of deep, well-drained soils on high mountainsides and alpine rims above timberline. Slopes are 8 to 50 percent. These soils formed in stony material derived from latite basalt. The parent material is very hard and resistant to weathering and is commonly fractured to a depth of several feet.

Typically, these soils have a surface mat of partly decomposed plant material. In a representative profile the surface layer is dark-brown very stony loam about 5 inches thick. The subsoil is brown very stony silt loam about 15 inches thick. The substratum to a depth of 60 inches is brown very stony silt loam that has many open voids between stones.

Meredith soils are at elevations of 11,000 to 12,600 feet. They receive approximately 30 inches of precipitation annually. The average annual soil temperature is 30° F. The average soil temperature in summer is 46° F. The vegetation is commonly alpine bluegrass, moss campion, silver cinquefoil, sedges, and alpine willow.

Permeability is moderate. Roots can penetrate to a depth of 60 inches or more, but available water capacity is low.

These soils are used for grazing, wildlife, and recreation.

Representative profile of Meredith very stony loam, 8 to 50 percent slopes, northwest of Devils Lake at an altitude of 12,400 feet; SE1/4 sec. 32, T. 45 N., R. 3 W., Hinsdale County:

O1—1 inch to 0, partly decomposed plant material.

A1—0 to 5 inches, dark-brown (7.5YR 4/2) very stony loam, dark brown (7.5YR 3/2) moist; weak, fine, granular structure; soft, very friable; 50 percent angular stone fragments; pH 5.0; clear, smooth boundary.

B2—5 to 20 inches, brown (7.5YR 5/4) very stony silt loam, dark brown (7.5YR 3/4) moist; moderate, medium, subangular blocky structure; slightly hard, friable; 60 percent angular stone fragments; pH 5.2; gradual, smooth boundary.

C—20 to 60 inches, brown (10YR 5/3) very stony silt loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable; many open voids; 70 percent angular stone fragments; pH 6.1.

Coarse fragments cover up to 50 percent of the surface area. The A horizon is typically very stony loam, but in places is very stony fine sandy loam and very stony silt loam. It ranges from dark brown or very dark grayish brown to brown or grayish brown. The B2 horizon is very stony loam or silt loam and ranges from brown to light brown. The content of coarse fragments in the B2 horizon and upper part of the C horizon ranges from 35 to 80 percent. It increases to 100 percent in the lower part of the C horizon.

Meredith very stony loam, 8 to 50 percent slopes (MeF).—This soil is in the extreme south-central part of the survey area on the Cannibal Plateau, on high mountainsides and rims above timberline.

Included with this soil in mapping are areas of Rock

outcrop and Rockslides on excessively steep terrain and rock streams in less steep areas. Included areas make up less than 15 percent of the total acreage.

This soil is used for range and wildlife and provides summer grazing for sheep, deer, and elk. Runoff is medium to rapid, depending on the slope. The erosion hazard is high. Capability unit VIIs-3 nonirrigated; Alpine Slopes range site.

Mergel Series

The Mergel series consists of deep, well-drained soils on upland hills and ridges. Slopes are 5 to 45 percent. These soils formed in alluvial fan and glacial sediment weathered mainly from rhyolitic tuff.

In a representative profile the surface layer is grayish-brown gravelly loam about 10 inches thick. The next layer is pale-brown gravelly loam about 6 inches thick. Below this to a depth of 60 inches is pale-brown and very pale brown very gravelly loam.

Mergel soils are at elevations of about 7,700 to 9,000 feet. The average annual soil temperature is 45° F. The average annual precipitation is about 15 inches. The native vegetation is commonly big sagebrush, phlox, native bluegrass, squirreltail, dryland sedge, wheatgrass, and pine needlegrass.

Permeability is moderately rapid. Roots can penetrate to a depth of 60 inches or more, but available water capacity is low.

These soils are used principally for grazing and wildlife.

The Mergel soils in this survey area are mapped only with Parlin soils.

Representative profile of Mergel gravelly loam; mapped in an area of Parlin-Mergel gravelly loams, 5 to 45 percent slopes, 1 mile south of Doyleville; NW1/4 sec. 11, T. 48 N., R. 3 E., Gunnison County:

A1—0 to 10 inches, grayish-brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, granular structure; slightly hard, very friable; 20 percent gravel and cobblestones; pH 8.0; clear, smooth boundary.

AC—10 to 16 inches, pale-brown (10YR 6/3) gravelly loam, brown (10YR 5/3) moist; weak, medium and coarse, subangular blocky structure; hard, friable; 30 percent cobblestones and gravel; calcareous; pH 8.2; gradual, wavy boundary.

C1ca—16 to 37 inches, very pale brown (10YR 7/3) very gravelly loam, brown (10YR 5/3) moist; massive; hard, friable; 60 percent gravel and cobblestones; calcareous; pH 8.4; clear, wavy boundary.

C2ca—37 to 60 inches, pale-brown (10YR 6/3) very gravelly loam, brown (10YR 5/3) moist; massive; slightly hard, friable; 70 percent gravel and cobblestones; calcareous; pH 8.4.

The A horizon is typically gravelly loam, but in places is gravelly sandy loam. It ranges from 8 to 14 inches in thickness and from grayish brown to dark grayish brown in color. It is commonly noncalcareous, but is calcareous in localized areas. The C horizon is typically very gravelly or very cobbly loam, but in places is gravelly sandy loam. The content of coarse fragments less than 10 inches in size ranges from 35 to 80 percent.

Mord Series

The Mord series consists of deep, well-drained soils on upland hills and valley-fill slopes. Slopes are 5 to 30 percent. These soils formed in gravelly and cobbly material weathered from rhyolite and breccia.

In a representative profile the surface layer is very dark gray loam about 10 inches thick. The subsurface layer is light brownish-gray loam about 3 inches thick. The next layer is mixed, light brownish-gray and brown gravelly clay loam about 14 inches thick. The subsoil is brown and pale-brown light gravelly clay about 25 inches thick. The substratum to a depth of 60 inches is pale-brown gravelly clay loam.

Mord soils are at elevations of 9,000 to 10,000 feet. The annual precipitation is 20 to 25 inches. The average annual soil temperature is 40° F. The native vegetation is commonly big sagebrush, Thurber fescue, nodding brome, big bluegrass, bearded wheatgrass, and scattered stands of aspen.

Permeability is slow. Roots can penetrate to a depth of 60 inches or more, and available water capacity is high.

These soils are used mainly for grazing, wildlife, and recreation. Small areas on the upper Ohio Creek drainage are irrigated.

Representative profile of Mord loam, 5 to 30 percent slopes, one-eighth mile south of the intersection of Antelope and Mill Creek roads; NW1/4 sec. 1, T. 51 N., R. 2 W., Gunnison County:

A1—0 to 10 inches, very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; strong, fine, granular structure; soft, very friable; 10 percent angular gravel and stones; pH 6.6; clear, wavy boundary.

A2—10 to 13 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak, medium, platy structure parting to moderate, fine, granular; hard, friable; 10 percent angular gravel; pH 6.6; clear, smooth boundary.

A&B—13 to 27 inches, mixed colors of light brownish-gray (10YR 6/2) and brown (10YR 5/3) gravelly clay loam, dark grayish brown (10YR 4/2) moist; moderate, medium, subangular blocky structure; slightly hard, friable; seams and nodules of B2t material surrounded by lighter colored A2 material; moderate continuous clay films on aggregates of B2t material; 20 percent angular gravel and cobblestones; pH 6.6; clear, smooth boundary.

B2t—27 to 40 inches, brown (10YR 5/3) gravelly light clay, dark brown (10YR 4/3) moist; moderate and strong, coarse, angular blocky structure parting to moderate and strong, medium, angular blocky; very hard, firm; thin continuous clay films on ped faces; 20 percent angular cobblestones and gravel; pH 6.6; gradual, smooth boundary.

B3t—40 to 52 inches, pale-brown (10YR 6/3) gravelly clay, dark brown (10YR 4/3) moist; weak and moderate, medium, subangular blocky structure; hard, firm; 30 percent angular gravel and cobblestones; thin patchy clay films on ped faces; pH 6.8; gradual, smooth boundary.

C—52 to 60 inches, pale-brown (10YR 6/3) gravelly clay loam, dark brown (10YR 4/3) moist; weak, medium and coarse, subangular blocky structure; hard, firm; 40 percent cobblestones and gravel; pH 6.8.

The A1 horizon is typically loam, but in places is stony loam. It ranges from 8 to 14 inches in thickness and from dark gray to grayish brown in color. The B2t horizon is gravelly or cobbly clay or heavy clay loam. Reaction is slightly acid to neutral. The content of angular stone fragments ranges from 5 to 35 percent. Bedrock is below a depth of 50 inches.

Mord loam, 5 to 30 percent slopes (MoE).—This soil is mainly in the north-central part of the survey area, commonly on northerly and easterly exposures.

Included with this soil in mapping are small areas of Leaps, Dollard, and Bogan soils on steep slopes or in places where the soil mantle is shallow over bedrock; areas of Duffson and Hopkins soils at lower elevations; and areas of Mord loam where slopes are more than 30 percent. Small rounded knobs and ridges that have a very high content of angular stone fragments are common. Also included are small areas where slopes are less than 5 percent or more than 30 percent. Included soils make up less than 12 percent of the total acreage.

Almost all the acreage is range. Small areas are irrigated for hay and pasture. Runoff is medium to rapid, and the erosion hazard is slight to moderate. Capability unit VIe-1 irrigated, VIe-4 nonirrigated; Subalpine Loam range site.

Morop Series

The Morop series consists of deep, well-drained soils on uplands. Slopes are 5 to 40 percent. These soils formed in old alluvial fan sediment and glacial till deposits that were derived from basaltic material.

In a representative profile the surface layer is dark grayish-brown stony loam about 6 inches thick. The subsoil, about 19 inches thick, is dark grayish-brown, brown, and pale-brown stony clay loam and clay. The substratum to a depth of 60 inches is very pale brown stony loam.

Morop soils are at elevations of 8,000 to 9,000 feet. The average annual soil temperature is 42° F. The annual precipitation is about 16 inches. The native vegetation is commonly big sagebrush, Arizona fescue, wheatgrass, and native bluegrass.

Permeability is slow. Roots can penetrate to a depth of 60 inches or more, and available water capacity is high.

These soils are used principally as range.

Representative profile of Morop stony loam, 5 to 40 percent slopes; NW1/4 sec. 24, T. 51 N., R. 1 W., Gunnison County:

A1—0 to 6 inches, dark grayish-brown (10YR 4/3) stony loam, very dark brown (10YR 2/2) moist; moderate, medium, granular structure; soft, very friable; about 15 percent angular stones, cobblestones, and gravel; pH 7.0; clear, smooth boundary.

B1t—6 to 10 inches, dark grayish-brown (10YR 4/2) stony clay loam, very dark brown (10YR 2/2) moist; moderate, medium, subangular blocky structure; hard, friable; thin continuous clay films on ped faces; many, dark-colored, ferromagnesian-rich minerals; about 15 percent angular stones, cobblestones, and gravel; pH 7.0; clear, smooth boundary.

B2t—10 to 20 inches, brown (10YR 5/3) stony clay, dark brown (10YR 4/3) moist; moderate, medium, angular blocky structure parting to moderate, fine, angular blocky; very hard, firm; thin continuous clay films; many, dark-colored, ferromagnesian-rich minerals; about 10 percent angular stones, cobblestones, and gravel; pH 7.4; clear, smooth boundary.

B3tca—20 to 25 inches, pale-brown (10YR 6/3) stony clay loam, brown (10YR 5/3) moist; moderate, medium, subangular blocky structure; very hard, friable; few, thin, patchy clay films on ped faces; many, dark-colored, ferromagnesian-rich minerals; about 20 percent angular stones, cobblestones, and gravel; strongly calcareous; thin white (10YR 8/2) lime crusts on bottom of coarse fragments and common fine lime segregations; pH 8.0; gradual, wavy boundary.

Cca—25 to 60 inches, very pale brown (10YR 7/3) stony loam, brown (10YR 5/3) moist; massive; hard, friable; about 30 percent angular stones, cobblestones, and gravel; strongly calcareous; thin white (10YR 8/2) lime crusts on bottom of coarse fragments and many fine and medium lime segregations; pH 8.4; gradual, smooth boundary.

The A horizon is typically stony loam, but in places is loam and light clay loam. It ranges from very dark grayish brown or grayish brown to brown or dark brown. The content of coarse fragments, dominantly stones, in the A and B horizons ranges from 5 to 35 percent.

Morop stony loam, 5 to 40 percent slopes (MrE).—This soil is mainly in the Ohio Creek area on south slopes of Flattop Mountain. In localized areas the surface layer is up to 35 percent stones.

Included with this soil in mapping are small areas of Cochetopa and Dollard soils and small areas where slopes are less than 5 percent or more than 40 percent.

Nearly all the acreage is in native vegetation and is used for grazing. Small areas are irrigated for hay and pasture. Runoff is slow or medium, and the erosion hazard is moderate. Capability unit VIe-1 irrigated, VIIs-1 nonirrigated; Mountain Loam range site.

Nutras Series

The Nutras series consists of deep, well-drained soils on ridgetops, mesas, and basalt flows. Slopes are 10 to 50 percent. These soils formed in stony material derived from latite basalt, which is resistant to weathering.

Typically, these soils have a 4-inch mat of undecomposed and partly decomposed needles, bark, and twigs. In a representative profile the mineral surface layer is white stony loam about 9 inches thick. The subsurface layer is about 6 inches of mixed pinkish-gray and reddish-brown stony clay loam. The subsoil is reddish-brown extremely stony clay about 25 inches thick. The substratum to a depth of 60 inches is reddish-brown extremely stony clay.

Nutras soils are at elevations of 10,000 to 11,500 feet. The annual precipitation is more than 20 inches. The average annual soil temperature is 38° F. The native vegetation is commonly Engelmann spruce, subalpine fir, and scattered aspen. The understory is Fendler bluegrass, spike trisetum, russet buffaloberry, mountain birch, and alder.

Permeability is slow, and available water capacity is moderate. Roots can penetrate to a depth of 60 inches or more.

These soils are used chiefly for woodland, wildlife, and watershed.

Representative profile of Nutras stony loam, 10 to 50 percent slopes, in a wooded area east of Powderhorn Creek; N1/2 sec. 33, T. 45 N., R. 2 W., Hinsdale County:

O1—4 inches to 0, undecomposed organic material grading to partially decomposed material, chiefly needles, bark, and twigs.

A2—0 to 9 inches, white (10YR 8/2) stony loam, very pale brown (10YR 7/3) moist; moderate, thin, platy structure parting to moderate, very fine, granular; soft, very friable; about 30 percent stones, cobblestones, and gravel; pH 5.4; gradual, smooth boundary.

A&B—9 to 15 inches, mixed colors of pinkish-gray (5YR 7/2) and reddish-brown (5YR 5/4) stony clay loam, reddish gray (5YR 5/2) and reddish brown (5YR 5/4) moist; moderate, medium and fine, subangular

blocky structure; slightly hard, friable; clayey B2t material imbedded in light-colored matrix similar to A2 material; thin patchy clay films on peds in clayey material; dark-colored ferromagnesian grains; about 30 percent stones, cobblestones, and gravel; pH 5.4; gradual, wavy boundary.

B2t—15 to 32 inches, reddish-brown (5YR 5/4) extremely stony clay, reddish brown (5YR 4/4) moist; strong, medium and fine, subangular blocky structure; extremely hard, very firm; thin continuous clay films on ped surfaces and on surface of rock fragments; many, dark-colored, ferromagnesian grains; about 10 percent prominent seams and streaks of red (2.5YR 5/8); about 60 percent basaltic stones, cobblestones, and gravel; pH 5.8; gradual, wavy boundary.

B3t—32 to 40 inches, reddish-brown (5YR 5/4) extremely stony and gravelly clay, reddish brown (5YR 4/4) moist; weak, coarse, subangular blocky structure; very hard, firm; common, thin, patchy clay films on ped faces; many, magnetic, ferromagnesian-rich grains; about 70 percent stones, cobblestones, and gravel; pH 6.4; gradual, wavy boundary.

C—40 to 60 inches, reddish-brown (5YR 5/4) extremely stony clay, reddish brown (5YR 4/4) moist; massive; very hard, firm; about 70 percent stones, cobblestones, and gravel; pH 6.4.

The O1 horizon ranges from 1 to 5 inches in thickness. The A2 horizon is typically stony loam, but in places is stony fine sandy loam. It ranges from 6 to 14 inches in thickness and is pinkish gray, brown, or white. It is 10 to 50 percent coarse fragments. The B2t horizon is 35 to 80 percent coarse fragments. It is reddish brown or light reddish brown. Reaction is medium acid to very strongly acid.

Nutras stony loam, 10 to 50 percent slopes (NuF).—This soil is in the Powderhorn drainage in the southern part of the survey area and in the Red Mountain area in the northern part. In old burned-over areas, which are now in aspen, the surface layer is light brownish gray and about 3 inches thick.

Included with this soil in mapping are small areas of Vulcan and Wetterhorn soils and areas of Stony rock land and Rock outcrop in the Powderhorn Creek drainage. Included soils make up less than 15 percent of the total acreage.

This soil is well suited to trees. Almost all the acreage is forest. Where forest fires and heavy logging have occurred, the forest is dominantly aspen and small numbers of conifers. Runoff is medium, and the erosion hazard is moderate. Capability unit VIIe-2 nonirrigated; woodland group 4.

Parlin Series

The Parlin series consists of deep, well-drained soils on hillsides, ridges, and benches. Slopes are 5 to 45 percent. These soils formed in locally transported channery and gravelly sediment weathered from rhyolite and similar rocks.

In a representative profile the surface layer is brown channery loam about 7 inches thick. The subsoil is brown channery loam and clay loam about 24 inches thick. The substratum to a depth of 60 inches is strongly calcareous, light brownish-gray very stony loam.

Parlin soils are at elevations of 7,700 to 9,000 feet. The average annual soil temperature is 44° F. The average soil temperature in summer is 62°. The average annual precipitation is about 16 inches. The vegetation is big sagebrush, Arizona fescue, native bluegrass, and wheatgrass.

Permeability is moderately slow, and available water capacity is moderate. Roots can penetrate to a depth of 60 inches or more.

These soils are used for grazing, recreation, and wildlife.

The Parlin soils in the Gunnison Area are mapped only with Hopkins and Mergel soils.

Representative profile of Parlin channery loam, 5 to 45 percent slopes, 2 miles south of Parlin; SE1/4 sec. 22, T. 49 N., R. 2 E., Gunnison County:

A1—0 to 7 inches, brown (7.5YR 5/2) channery loam, dark brown (7.5YR 3/2) moist; strong, very fine, granular structure; soft, very friable; 30 percent stone fragments and gravel; pH 7.2; clear, smooth boundary.

B1—7 to 11 inches, brown (7.5YR 5/3) channery loam, dark brown (7.5YR 3/3) moist; weak, medium, subangular blocky structure parting to strong, fine, granular; slightly hard, very friable; 30 percent stone fragments; pH 7.2; clear, smooth boundary.

B2t—11 to 25 inches, brown (7.5YR 5/4) channery clay loam, dark brown (7.5YR 4/4) moist; moderate, medium and fine, subangular blocky structure; very hard, friable; thin continuous clay films on ped faces; 30 percent stone fragments and gravel; pH 7.4; clear, smooth boundary.

B3t—25 to 31 inches, brown (7.5YR 5/4) channery clay loam, dark brown (7.5YR 4/4) moist; weak, medium, subangular blocky structure; hard, very friable; thin patchy clay films on ped faces; 30 percent stone fragments and stones; pH 7.8; gradual, wavy boundary.

IICca—31 to 60 inches, light brownish-gray (10YR 6/2) very stony loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable; 80 percent flagstones; calcareous; pH 8.0.

The A horizon is typically channery loam, but in places is channery sandy loam, gravelly loam, and loam. It ranges from 6 to 12 inches in thickness and from brown or very dark brown to grayish brown or dark grayish in color. The B2t horizon is channery or gravelly clay loam. The content of coarse fragments ranges from 15 to 35 percent. Depth to fractured bedrock is commonly more than 60 inches, but in places it is 40 inches.

Parlin-Hopkins channery loams, 5 to 45 percent slopes (PhF).—This mapping unit is on uplands throughout the central part of the survey area. It is approximately 55 percent Parlin channery loam and 25 percent Hopkins channery loam. Each soil has the profile described as typical of its series. The Parlin soil generally is on north and easterly exposures, and the Hopkins soil is on windswept, south and westerly exposures.

Included with these soils in mapping are small areas of Posant, Lucky, and Duffson soils; small areas of Rock outcrop and Stony rock land; small areas of Alluvial land along drainageways; small areas where slopes are greater than 45 percent; and areas of eroded Parlin and Hopkins soils. Included soils make up less than 20 percent of this mapping unit.

This unit is best suited to grazing and wildlife habitat. Runoff is medium to rapid, and the erosion hazard is moderate to high. Capability unit VIIe-3 nonirrigated; Parlin soil in Mountain Loam range site, Hopkins soil in Dry Mountain Loam range site.

Parlin-Mergel gravelly loams, 5 to 45 percent slopes (PmF).—This mapping unit is on uplands mainly in the northern and eastern parts of the survey area. It is about 65 percent Parlin soil and 20 percent Mergel soil. The Parlin soil is commonly on northerly and

easterly exposures where the effective moisture is greater. It has a profile similar to the one described as representative of the Parlin series, but the surface layer and subsoil are gravelly. The Mergel soil is on windswept, southerly exposures. It has the profile described as representative of the Mergel series.

Included with these soils in mapping are areas of Dollard and Corpening soils, areas of Rock outcrop commonly on the steeper slopes, and small areas of Evanston and Dewville soils on small fans. Included soils make up less than 15 percent of the total acreage.

Nearly all the acreage is in native vegetation and is used as range. A few very small areas are irrigated. Runoff is medium or rapid, and the erosion hazard is moderate or high. Capability unit VIIe-3 nonirrigated; Parlin soil in Mountain Loam range site, Mergel soil in Dry Mountain Loam range site.

Passar Series

The Passar series consists of moderately deep, well-drained soils on upland hillsides, ridges, and alluvial fans. Slopes are 5 to 30 percent. These soils formed in locally transported stony alluvium that was derived from rhyolite and tuff.

In a representative profile the surface layer is very dark gray loam about 10 inches thick. The subsoil is brown and reddish-brown clay loam and extremely stony clay and clay loam about 32 inches thick. The substratum to a depth of 60 inches is brown extremely stony clay loam.

Passar soils are at elevations of 8,000 to 9,500 feet. They receive approximately 20 inches of annual precipitation. The average annual soil temperature is 38° F. The native vegetation is commonly silver sagebrush, Thurber fescue, nodding brome, big bluegrass, bearded wheatgrass, and widely scattered clumps of aspen.

Permeability is slow, and available water capacity is moderate. Roots can penetrate to a depth of 60 inches or more.

These soils are important for grazing, recreation, and wildlife.

The Passar soils in this survey area are mapped only with Youman soils.

Representative profile of Passar loam, 5 to 30 percent slopes; SW1/4 sec. 20, T. 47 N., R. 4 W., Gunnison County:

A1—0 to 10 inches, very dark gray (7.5YR 3/1) loam, black (7.5YR 2/1) moist; granular structure; dry, very friable; 5 percent angular gravel; pH 6.4; clear, smooth boundary.

B1t—10 to 15 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate, medium and fine, subangular blocky structure; hard, firm; thin patchy clay films on ped faces; 10 percent angular gravel; pH 6.2; clear, smooth boundary.

B2t—15 to 36 inches, reddish-brown (5YR 5/4) extremely stony clay, reddish brown (5YR 4/4) moist; weak, medium, prismatic structure parting to moderate to strong, medium to fine, angular blocky; extremely hard, firm; thin continuous clay films on ped faces; 60 percent angular stones, gravel, and cobblestones; pH 6.2; gradual, smooth boundary.

B3t—36 to 42 inches, brown (7.5YR 5/4) extremely stony heavy clay loam, dark brown (7.5YR 4/4) moist; weak, medium, subangular blocky structure; very hard, firm; thin patchy clay films on ped faces; 70 percent stones, cobblestones, and gravel; pH 6.4; gradual, smooth boundary.

C—42 to 60 inches, brown (7.5YR 5/4) extremely stony clay loam, dark brown (7.5YR 4/4) moist; massive; hard, friable; 70 percent angular stones, cobblestones, and gravel; pH 6.6.

The A horizon is typically loam, but in places is stony loam. It ranges from 4 to 14 inches in thickness and from very dark grayish brown to brown in color. The B horizon ranges from brown to reddish brown. The content of coarse fragments, dominantly stones, in the B horizon ranges from 35 to 70 percent.

Posant Series

The Posant series consists of shallow, well-drained soils on hillsides, ridges, and mountainsides. Slopes are 10 to 60 percent. These soils formed in material weathered in place from quartz latite and breccia.

Typically these soils have a 5-inch mat of needles and twigs. In a representative profile the surface layer is dark grayish-brown gravelly loam about 5 inches thick. The subsoil, about 14 inches thick, is brown very gravelly heavy clay loam. Bedrock is at a depth of 19 inches.

Posant soils are at elevations of 8,000 to 9,000 feet. They receive about 16 inches of annual precipitation. The average annual soil temperature is less than 44° F. The native vegetation is commonly scattered ponderosa pine, big sagebrush, Indian ricegrass, Arizona fescue, mountain muhly, and wheatgrass.

Permeability is moderate. Roots can penetrate to a depth of no more than 20 inches, and available water capacity is low.

These soils are used mostly for timber, grazing, and wildlife.

Representative profile of Posant gravelly loam, 10 to 60 percent slopes; SE1/4 sec. 3, T. 45 N., R. 4 W., Gunnison County:

O1—5 inches to 0, partly decomposed pine needles.

A1—0 to 5 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak, medium, subangular blocky structure parting to moderate, fine, granular; slightly hard, friable; 15 percent angular gravel; pH 6.8; clear, wavy boundary.

B21t—5 to 10 inches, brown (7.5YR 5/3) very gravelly heavy clay loam, dark brown (7.5YR 3/3) moist; strong, medium and fine, subangular blocky structure; hard, firm; thin continuous clay films on ped faces; 60 percent angular gravel; pH 6.5; clear, smooth boundary.

B22t—10 to 19 inches, brown (7.5YR 5/3) very gravelly heavy clay loam, dark brown (7.5YR 4/3) moist; strong, medium and fine, subangular blocky structure; hard, firm; thin continuous clay films on ped faces; 70 percent angular gravel; pH 6.5; abrupt, wavy boundary.

R—19 inches, hard quartz latite bedrock.

The A horizon is typically gravelly loam, but in places is stony loam. It ranges from 4 to 10 inches in thickness and from dark grayish brown to grayish brown in color. The B2t horizon ranges from brown to dark brown; it is commonly heavy clay loam, but ranges to clay. The content of coarse fragments, mainly gravel, in the B2t horizon is 35 to 80 percent. The soil is slightly acid or neutral.

Posant very rocky loam, 10 to 60 percent slopes (PoF).—This soil is mainly in the southern part of the survey area along the Lake Fork of the Gunnison River. It is commonly on southern exposures. Rock outcrop makes

up 30 percent of the mapped area. It commonly forms escarpments or columns on steeper terrain.

Included with this soil in mapping are areas of Woodall soils on the higher parts of slopes and on ridgetops, small areas of Vulcan and Wetterhorn soils mainly on the more humid northerly exposures, and areas of Rockslides commonly below Rock outcrop escarpments. Included soils make up less than 15 percent of the total acreage.

This soil is in native vegetation. Most of the acreage is grazed by livestock. Deer and elk often graze the sunny slopes in winter. Runoff is medium to rapid, and the erosion hazard is moderate to high. Capability unit VIIs-2 nonirrigated; woodland group 1.

Powderhorn Series

The Powderhorn series consists of deep, well-drained soils on uplands and valley-fill slopes. Slopes are 5 to 30 percent. These soils formed in locally transported alluvium weathered from granite, gneiss, and schist.

Typically, these soils have a 4-inch mat of partially decomposed plant remains. In a representative profile the surface layer is dark-gray loam about 12 inches thick. The subsurface layer is pinkish-white gravelly loam and gravelly clay loam about 12 inches thick. The subsoil is reddish-brown gravelly clay about 22 inches thick. The substratum to a depth of 60 inches is gravelly heavy clay loam.

Powderhorn soils are at elevations of 8,500 to 10,000 feet. They receive about 20 inches of annual precipitation. The average annual soil temperature is about 46° F. The native vegetation is commonly silver sagebrush, Thurber fescue, mountain bluebrass, and scattered clumps of aspen, Englemann spruce, and Douglas-fir.

Permeability is slow. Roots can penetrate to a depth of 60 inches or more, and available water capacity is high.

These soils are used mainly for livestock grazing and wildlife.

Representative profile of Powderhorn loam, 5 to 30 percent slopes; SE1/4 sec. 5, T. 46 N., R. 1 W., Gunnison County:

O1—4 to 2 inches, undecomposed organic material, chiefly leaves, twigs and grass.

O2—2 inches to 0, partly decomposed organic material.

A1—0 to 12 inches, dark-gray (10YR 4/4) loam, black (10YR 2/1) moist; strong, fine, crumb and granular structure; soft, very friable; pH 6.6; clear, smooth boundary.

A2—12 to 17 inches, pinkish-white (7.5YR 8/2) gravelly loam, pinkish gray (7.5YR 6/2) moist; moderate, thin, platy structure parting to moderate, very fine, subangular blocky and granular; very hard, very friable; 15 percent fine, angular, granitic gravel; pH 6.2; gradual, wavy boundary.

A&B—17 to 24 inches, mixed colors, including pinkish white (7.5YR 8/2) and reddish-brown (5YR 5/3), gravelly clay loam, pinkish gray (7.5YR 6/2) and reddish brown (5YR 4/3) moist; crushed color is reddish brown (5YR 4/3) moist; moderate, very fine, subangular blocky structure; hard, very friable; seams and nodules of clayey B2t material imbedded in loamy A2 matrix; 25 percent fine, angular, granitic gravel; pH 6.2; gradual, irregular boundary.

B2t—24 to 40 inches, reddish-brown (5YR 5/4) gravelly clay, reddish brown (5YR 4/3) moist; moderate, medium, angular blocky structure; extremely hard, firm; thick continuous clay films on ped faces; 20 percent granitic gravel; pH 6.0; gradual, wavy boundary.

B3t—40 to 46 inches, reddish-brown (5YR 5/3) gravelly light clay, reddish brown (5YR 4/3) moist; weak, medium, subangular blocky structure; extremely hard, friable; many, thin, patchy clay films on ped faces; 20 percent granitic gravel; pH 6.0; gradual, smooth boundary.

C—46 to 60 inches, reddish-brown (5YR 5/4) gravelly heavy clay loam, reddish brown (5YR 4/4) moist; massive; extremely hard, very friable; few manganese concretions; 20 percent fine, angular, granitic gravel; pH 6.2.

In many places the soil does not have an O horizon. The A1 horizon ranges from 7 to 15 inches in thickness and from dark gray to grayish brown in color. The A2 horizon ranges from pinkish white or pinkish gray. The B2t horizon is typically gravelly heavy clay loam or clay that is 35 to 45 percent clay. The content of coarse fragments, most of which are fine and very fine angular granitic pebbles, ranges from 10 to 35 percent. The soil ranges from medium acid to neutral.

Powderhorn loam, 5 to 30 percent slopes (PwE).—This soil is mainly near Vulcan and Powderhorn. Small eroded areas have a 7- to 10-inch surface layer.

Included with this soil in mapping are small areas of Rock outcrop and Stony rock land and areas of Cebolia soils. Also included are small areas of eroded Powderhorn soils where slopes are 30 to 40 percent. Included soils make up less than 10 percent of the total acreage.

This soil is almost entirely in native vegetation and is used for grazing in summer and early in fall. It also provides habitat for deer and elk. Runoff is medium, and the erosion hazard is moderate. Capability unit VIe-4 nonirrigated; Subalpine Loam range site.

Redcloud Series

The Redcloud series consists of deep, well-drained soils on alluvial fans and valley-fill slopes. Slopes are 3 to 30 percent. These soils formed in alluvium that was derived from rhyolite and rhyolitic tuff.

In a representative profile the surface layer is brown channery loam about 12 inches thick. The subsoil is light-brown channery loam about 10 inches thick. The substratum to a depth of 60 inches is very pale brown and light yellowish-brown, calcareous channery loam.

Redcloud soils are at elevations of 9,000 to 10,000 feet. They receive approximately 12 inches of annual precipitation. The average annual soil temperature is 38° F., and the average soil temperature in summer is 54°. The native vegetation is commonly fringed sage, slimstem muhly, dryland sedge, and Arizona fescue.

Permeability is moderate, and available water capacity is moderate. Roots can penetrate to a depth of 60 inches or more.

These soils are used mainly as range and wildlife habitat.

Representative profile of Redcloud channery loam, 3 to 30 percent slopes, on a convex, north-facing slope in Cochetopa Park; SW1/4 sec. 10, T. 46 N., R. 2 E., Saguache County:

A1—0 to 12 inches, brown (7.5YR 5/3) channery loam, dark brown (7.5YR 3/3) moist; weak, medium, subangular blocky structure parting to moderate, very fine, granular; soft, very friable; 15 percent stone

fragments, mostly rhyolite and tuff; pH 7.2; clear, smooth boundary.

B2—12 to 22 inches, light-brown (7.5YR 6/3) channery loam, dark brown (7.5YR 4/3) moist; moderate, medium, subangular blocky structure; slightly hard, very friable; 20 percent stone fragments; pH 7.2; clear, wavy boundary.

C1ca—22 to 36 inches, very pale brown (10YR 7/3) channery loam, brown (10YR 4/3) moist; massive; slightly hard, very friable; 25 percent stone fragments; calcareous; white (10YR 8/2) calcium carbonate concretions and coatings on rock fragments; pH 8.0; gradual, wavy boundary.

C2ca—36 to 60 inches, light yellowish-brown (2.5Y 6/3) channery loam, light olive brown (2.5Y 5/3) moist; massive; hard, very friable; 20 percent stone fragments; calcareous; some visible calcium carbonate concretions and coatings on bottom of rock fragments; pH 8.0.

The A horizon is channery loam and channery fine sandy loam. It ranges from 6 to 15 inches in thickness and from grayish brown or very dark grayish brown to brown in color. The B2 horizon ranges from light brown or brown to grayish brown or light brownish gray. The soil profile ranges from neutral to moderately alkaline. The content of channery material ranges from 15 to 35 percent.

Redcloud channery loam, 3 to 30 percent slopes (RcE).—This soil is principally in the Cochetopa Park area. Included with this soil in mapping are areas of Evanston, Parlin, and Hopkins soils and areas of eroded Redcloud soil commonly at the higher elevations. Also included are small acreages of Alluvial land, wet, in small drainageways and a few areas of Rock outcrop and Stony rock land on the steeper slopes. Included soils make up less than 15 percent of the total acreage.

Nearly all the acreage is in native vegetation and is used for grazing and wildlife. Runoff is medium, and the erosion hazard is moderate. Capability unit VIe-1 irrigated, VIe-2 nonirrigated; Mountain Outwash range site.

Rock Outcrop

Rock outcrop (Ro) consists of bare exposures of bedrock along canyon walls, on escarpments surrounding mesa tops, and on very steep upland slopes. It is more than 90 percent exposed bedrock, principally gneiss, schist, intrusive and extrusive igneus rocks, breccia, and small quantities of sandstone and shale. Mapped areas are more than 3 acres in size.

Included with Rock outcrop in mapping are small areas of a very shallow soil that is commonly droughty and supports sparse vegetation.

Rock outcrop provides concealment for wildlife and adds to the scenic value of the landscape. It is used principally for wildlife and recreation. Capability unit VIIIs-1.

Rockslides

Rockslides (Rs) consists of loose, angular rock fragments that range from small pebbles to boulders several feet in diameter. It is commonly on steep upland slopes below Rock outcrop cliffs and escarpments. Physical weathering cracks the Rock outcrop and seams form. Rock fragments break loose and are carried downslope by gravity. They form aprons and fans, depending on how they fall. Some fall from cliffs. Some are carried down in snowslides. Many of the higher areas are unstable and are likely to slide at any time. Many areas of Rockslides are along the edges of the Cannibal Plateau.

Rockslides can be many feet thick or only a thin mantle covering the original soil. Trees and shrubs grow between the rocks where soil material is near the surface. Older areas that have become stabilized support sparse stands of timber and grass, even though the surface is still very stony.

Rockslides is valuable in maintaining water yields because snow accumulates between the rocks in winter and is slower to melt during spring thaw. It absorbs runoff from heavy rain and rapidly melting snow and allows a more even distribution of water to springs and creeks. It also protects the more erodible soils below. Capability unit VIIIs-2.

Ruby Series

The Ruby series consists of deep, well-drained soils on upland ridges and benches. Slopes are 5 to 40 percent. These soils formed in locally transported gravelly material that was derived from rhyolite and rhyolitic tuff.

In a representative profile the surface layer is brown gravelly sandy loam about 8 inches thick. The subsoil is brown gravelly clay loam about 5 inches thick. Overlapping rhyolite flagstone that contains many voids is at a depth of 13 inches.

Ruby soils are at elevations of 9,000 to 10,000 feet. They receive about 20 inches of annual precipitation. The average annual soil temperature is about 38° F. The native vegetation is commonly big sagebrush, native bluegrass, Columbia needlegrass, Letterman needlegrass, and thin stands of Thurber fescue.

Permeability is moderate. Roots can penetrate to a depth of only about 13 inches, and available water capacity is low.

These soils are important for grazing, recreation, and wildlife.

Representative profile of Ruby gravelly sandy loam, 5 to 30 percent slopes, one-half mile north of Rock Creek Cow Camp; NW1/4 sec. 21, T. 46 N., R. 1 W., Saguache County:

A1—0 to 8 inches, brown (7.5YR 5/2) gravelly sandy loam, dark brown (7.5YR 3/2) moist; moderate, very fine, granular structure; soft, very friable; 15 percent gravel; pH 6.5; clear, wavy boundary.

B2t—8 to 13 inches, brown (7.5YR 5/4) gravelly clay loam, dark brown (7.5YR 4/4) moist; moderate, medium, subangular blocky structure; hard, very friable; thin continuous clay films on ped faces; 25 percent gravel; pH 6.5; clear, wavy boundary.

C—13 to 60 inches, beds of highly fractured rhyolite consisting of overlapping flagstones; many open voids up to 1 inch wide.

The A horizon is typically gravelly sandy loam, but in places is loam and very stony sandy loam. It is 5 to 12 inches thick and dark brown or brown. The content of angular gravel and stones ranges from 5 to 35 percent by volume. Overlapping flagstones of rhyolite and rhyolitic tuff are at a depth of 10 to 20 inches. The soil is slightly acid or neutral.

Ruby gravelly sandy loam, 5 to 30 percent slopes (RuE).—This soil is mainly in the southern part of the survey area in the vicinity of Rock Creek Cow Camp. It has

the profile described as representative of the series. At elevations near 10,000 feet, the surface layer is dark brown.

Included with this soil in mapping are areas of Woosley, Vulcan, and Cebolia soils and small areas of Ruby soils where slopes are 30 to 45 percent. Also included are small areas of Rock outcrop and Stony rock land on the steeper slopes. Included soils make up 15 percent of the total acreage.

Most of the acreage is in native vegetation and is used for grazing and wildlife. Permeability is moderate. Runoff is medium or high, and the erosion hazard is moderate or high. Capability unit VIIe-3 nonirrigated; Shallow Subalpine range site.

Ruby extremely rocky sandy loam, 5 to 40 percent slopes (RyE).—This mapping unit is in the south-central part of the survey area on upland benches and side slopes, mainly on southerly and westerly exposures. It is 65 percent Ruby very stony sandy loam and 20 percent Rock outcrop. This Ruby soil has a profile similar to the one described as representative of the series, but the surface layer is very stony. Loose stones cover 30 percent of the surface area.

Included with this soil in mapping are areas of Stony rock land and small areas of Woosley, Vulcan, and Cebolia soils. Included soils make up 15 percent of the total acreage.

All the acreage is in native vegetation and is used for grazing and wildlife. Runoff is medium or rapid, and the erosion hazard is moderate to high. Capability unit VIIe-3 nonirrigated; Shallow Subalpine range site.

Sapinero Series

The Sapinero series consists of deep, well-drained soils on old landslides and alluvial fans. Slopes are 10 to 50 percent. These soils formed in stony alluvium and colluvium weathered mainly from rhyolite and rhyolitic tuff.

Typically, these soils have a 3-inch mat of undecomposed and partly decomposed leaves, needles, and twigs. In a representative profile the surface layer is grayish-brown stony loam about 4 inches thick. The subsurface layer is light-gray very stony loam about 15 inches thick. The next layer is mixed light-gray and light-brown extremely stony clay loam about 15 inches thick. The subsoil is brown extremely stony clay loam about 10 inches thick. The substratum to a depth of 60 inches is overlapping rhyolitic flagstone.

Sapinero soils are at elevations of 9,500 to 10,000 feet. They receive from 18 to 20 inches of precipitation annually. The average annual soil temperature is 34° F. The vegetation is Engelmann spruce, subalpine fir, and aspen. The understory plants are chiefly prostrate juniper, Oregongrape. Columbia needlegrass, Thurber fescue, and mountain brome.

Permeability is moderately slow, and available water capacity is moderate. Roots can penetrate to a depth of 60 inches or more.

These soils are used mainly for woodland, wildlife, and watershed.

The Sapinero soils in this survey area are mapped only with Shule soils.

Representative profile of Sapinero stony loam, mapped in an area of Shule and Sapinero loams, 10 to 50 percent slopes; N1/2 sec. 10, T. 47 N., R. 5 W., Gunnison County:

O1—3 inches to 0, surface litter of undecomposed and partially decomposed leaves and needles of aspen, spruce, and fir trees.

A1—0 to 4 inches, grayish-brown (10YR 5/2) stony loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, granular structure; soft, very friable; about 10 percent stones and gravel; pH 7.0; clear, smooth boundary.

A2—4 to 19 inches, light-gray (10YR 7/2) very stony loam, grayish brown (10YR 5/2) moist; weak, fine, granular structure; soft, very friable; 20 percent stones, cobblestones, and gravel; pH 6.4; clear, wavy boundary.

A&B—19 to 34 inches, mixed light-gray (10YR 7/2) and light-brown (7.5YR 6/3) extremely stony clay loam, brown (10YR 5/3) and dark brown (7.5YR 4/3) moist; weak, fine, subangular blocky structure; slightly hard, friable; seams and nodules of clayey B2t material and lighter colored A2 material; thin patchy clay films and bleached sand grains on ped faces; 50 percent stones, cobblestones, and gravel; pH 6.4; gradual, irregular boundary.

B2t—34 to 44 inches, brown (7.5YR 5/3) extremely stony clay loam, dark brown (7.5YR 4/3) moist; moderate, fine, subangular blocky structure; hard, firm; thin continuous clay films on ped faces; about 60 percent angular stones, cobblestones, and gravel; pH 6.4; gradual, wavy boundary.

IIC—44 to 60 inches, overlapping rhyolitic flagstone; open, 1- to 2-inch voids; clay loam soil material in narrow seams and as coatings on flagstones in the upper part decreasing to none within 3 to 5 inches.

The O1 horizon is 2 to 4 inches thick. The A horizon is loam or stony loam. The B2t horizon is typically extremely stony clay loam, but in places is extremely stony sandy clay loam. The solum ranges from medium acid to neutral. The content of coarse fragments, dominantly stones, ranges from 50 to 80 percent.

Shule Series

The Shule series consists of moderately deep, well-drained soils on hillsides, ridges, and mountainsides. Slopes are 10 to 50 percent. These soils formed in locally transported material that was derived from rhyolite or rhyolitic tuff.

Typically, these soils have a 4-inch mat of undecomposed and partly decomposed needles, bark, and twigs. In a representative profile the mineral surface layer is pinkish-gray loam about 8 inches thick. The next layer is mixed pinkish-gray and brown heavy loam about 8 inches thick. The subsoil is reddish-brown clay loam about 18 inches thick. Rhyolite bedrock is at a depth of 34 inches.

Shule soils are at elevations of 9,500 to 10,500 feet. The average annual precipitation is 18 to 20 inches, and the average annual soil temperature is 34° F. The native vegetation is commonly Engelmann spruce, subalpine fir, and aspen.

Permeability is slow. Roots can penetrate to a depth of only about 36 inches, and available water capacity is low.

These soils are used mainly for timber, wildlife, and watershed.

Representative profile of Shule loam, 10 to 50 percent

slopes; SE1/4 sec. 36, T. 47 N., R. 5 W., Gunnison County:

O1—4 inches to 1 inch, organic material consisting of bark, twigs, leaves, and needles.
O2—1 inch to 0, partly decomposed organic material.
A2—0 to 8 inches, pinkish-gray (7.5YR 7/2) loam, brown (7.5YR 5/2) moist; weak, medium, subangular blocky structure parting to moderate, fine, granular; weak platy structure in places; soft, very friable; 5 percent gravel and stones; pH 7.0; clear, smooth boundary.
A&B—8 to 16 inches, mixed-colored, including pinkish-gray (7.5YR 7/2) and brown (7.5YR 5/3), heavy loam, brown (7.5YR 5/2) and dark brown (7.5YR 4/3) moist; moderate, medium, subangular blocky structure parting to moderate, fine, granular; slightly hard, very friable; seams and nodules of B2t material imbedded in A2 matrix; 10 percent stones and gravel; pH 6.8; gradual, irregular boundary.
B2t—16 to 34 inches, reddish-brown (5YR 5/3) clay loam, reddish brown (5YR 4/3) moist; moderate, medium, subangular blocky structure; hard, friable; thin nearly continuous clay films on ped faces; 10 percent rhyolite rock, stones, and gravel; pH 6.6; clear, wavy boundary.
R—34 to 60 inches, rhyolite.

The A horizon is typically loam, but in places is gravelly and stony loam. The A2 horizon ranges from 6 to 12 inches in thickness and from pinkish gray to pink or light gray to very pale brown in color. The B2t horizon ranges from reddish brown to light reddish brown. The soil is slightly acid or neutral. The content of angular gravel and stones ranges from 5 to 35 percent. Depth to bedrock ranges from 20 to 40 inches.

Shule and Sapinero loams, 10 to 50 percent slopes (SsF).—This mapping unit is mainly in the Blue Mesa and Pine Creek parts of the survey area. It is about 65 percent Shule loam and 20 percent Sapinero loam. Each soil has the profile described as typical of its series. The moderately sloping Shule soil is mostly on mountainsides. The Sapinero soil is mostly on ridges.

Included with these soils in mapping are areas of Youman and Sunshine soils in small parks and clearings and small areas of Vulcan soils on the east side of Pine Creek. These inclusions make up less than 15 percent of the total acreage.

This unit is almost entirely forested, mainly Engelmann spruce and subalpine fir. Areas where forest fire and logging have been extensive are dominantly in stands of aspen and scattered conifers.

In this unit runoff is medium to rapid, and the erosion hazard is moderate to high. Use and management are about the same for both soils. Capability unit VIIe-2 nonirrigated; woodland group 4.

Spring Creek Series

The Spring Creek series consists of shallow, well-drained soils on upland ridges and mountainsides. Slopes are 5 to 40 percent. These soils formed in locally transported stony material that was derived from rhyolitic tuff and breccia.

In a representative profile the surface layer is dark grayish-brown stony loam 9 inches thick. Below this is pale-brown, calcareous gravelly and very gravelly loam about 10 inches thick. Rhyolitic tuff is at a depth of 19 inches.

Spring Creek soils receive from 11 to 14 inches of precipitation. The average annual soil temperature is 42° F. The average soil temperature in summer is about 62°. The native vegetation is commonly fringed sage, winterfat, phlox, western wheatgrass, squirreltail, dryland sedge, and slimstem muhly.

Permeability is moderately rapid. Roots can penetrate to a depth of only about 20 inches, and available water capacity is low.

Most of the acreage is in native vegetation and is used as range and wildlife habitat.

The Spring Creek soils in this survey area are mapped only with Duffson soils.

Representative profile of Spring Creek stony loam in native vegetation; NW1/4 sec. 3, T. 49 N., R. 1 W., Gunnison County:

A1—0 to 9 inches, dark grayish-brown (10YR 4/2) stony loam, very dark grayish brown (10YR 3/2) moist; weak, fine, subangular blocky structure; soft, friable; 10 percent angular stones and gravel; pH 6.8; clear, smooth boundary.
C1ca—9 to 15 inches, pale-brown (10YR 6/3) gravelly loam, dark brown (10YR 4/3) moist; weak, fine, subangular blocky structure; slightly hard, friable; 40 percent angular gravel; calcareous; thin white (10YR 8/2) lime coats on the base of gravel; pH 8.0; clear, smooth boundary.
C2ca—15 to 19 inches, pale-brown (10YR 6/3) very gravelly loam, brown (10YR 5/3) moist; massive; soft, very friable; 80 percent gravel, cobblestones, and stones; calcareous; pH 8.2; clear, smooth boundary.
R—19 inches, rhyolitic tuff.

The A horizon is typically stony loam, but in places is loam and channery loam. It is 4 to 10 inches thick. The content of coarse fragments ranges from 35 to 60 percent. Depth to bedrock is 10 to 20 inches.

Stony Rock Land

Stony rock land (St) consists mostly of exposed bedrock, loose stones, boulders, and soils that are very shallow over bedrock. Exposed bedrock and stones cover 25 to 90 percent of the surface area. Common rock types are rhyolite, tuff, quartz latite, sandstone, granite, breccia, gneiss, and schist and small outcrops of silty shale. Slopes range from 10 to 80 percent. Included in mapping are small areas of soils that are up to 40 inches deep.

Generally the largest areas of exposed bedrock are on southerly exposures. The very shallow soil between rocks has a very high content of loose stones. Less bedrock is exposed on northerly exposures, and areas of very shallow soils are larger. Northerly exposures commonly support more dense vegetation than southerly exposures.

Stony rock land is somewhat intermittent throughout the survey area. It is commonly on steeper terrain. The vegetation varies widely, depending on moisture, elevation, and exposure. Sparse stands of climatically adapted grasses, shrubs, and forbs are dominant at lower elevations. Open stands of conifers and aspen are common where moisture is in excess of 18 inches or elevations are more than 8,000 feet.

Stony rock land provides concealment and escape for wildlife. Deer and elk often graze the sunny slopes in winter. Capability unit VIIIs-3.

Sunshine Series

The Sunshine series consists of deep, well-drained soils on mesas and valley-fill slopes. Slopes are 5 to 35 percent. These soils formed in alluvium that was derived from rhyolite and rhyolitic tuff.

In a representative profile the surface layer is very dark gray loam about 11 inches thick. The subsurface layer is about 4 inches of pinkish-gray loam. Next is a 5-inch layer of pinkish-gray and brown gravelly loam. The subsoil is brown extremely stony clay about 16 inches thick. The substratum to a depth of 60 inches is loose, overlapping, rhyolitic flagstone that has 1- to 2-inch voids between the rocks.

Sunshine soils are at elevations of 9,000 to 10,000 feet. They receive about 20 inches of annual precipitation. The annual soil temperature is about 38° F. The average soil temperature in summer is less than 52°. The native vegetation is commonly big sagebrush, silver sagebrush, and scattered clumps of aspen. Grasses are chiefly Thurber fescue, nodding brome, and mountain bluegrass.

Permeability is slow. Roots can penetrate to a depth of only about 36 inches, and available water capacity is low.

These soils are important for grazing, recreation, and wildlife.

Representative profile of Sunshine loam, 5 to 35 percent slopes; NW1/4 sec. 17, T. 45 N., R. 2 E., Saguache County:

A1—0 to 11 inches, very dark gray (7.5YR 3/1) loam, black (10YR 2/1) moist; moderate, medium, granular structure parting to moderate, fine, granular; soft, very friable; 10 percent angular rhyolitic gravel; pH 6.8; clear, smooth boundary.

A2—11 to 15 inches, pinkish-gray (7.5YR 7/2) gravelly loam, brown (7.5YR 5/2) moist; moderate, fine, granular structure; soft, very friable; about 15 percent angular gravel and cobblestones; pH 6.8; clear, wavy boundary.

A&B—15 to 20 inches, mixed colors pinkish-gray (7.5YR 7/2) and brown (7.5YR 5/2) gravelly loam, brown (7.5YR 5/2) and dark brown (7.5YR 4/4) moist; weak, medium, subangular blocky structure; slightly hard, friable; about 40 percent streaks and seams of B2t material imbedded in matrix of A2 material; few, thin, patchy clay films on ped faces; about 20 percent angular gravel and cobblestones; pH 6.8; gradual, wavy boundary.

B2t—20 to 36 inches, brown (7.5YR 5/4) extremely stony clay, dark brown (7.5YR 4/4) moist; moderate, medium, angular blocky structure; very hard, firm; continuous medium clay films on ped faces; about 60 percent stones, cobblestones, and gravel; pH 6.8; gradual, wavy boundary.

IIC—36 to 60 inches, loose overlapping flagstones; 1- to 2-inch open interstices between rocks not filled with soil material.

The A1 horizon is typically loam, but in places is gravelly loam and stony loam. It ranges from 8 to 15 inches in thickness and from very dark gray to gray or dark brown to brown and dark grayish brown or grayish brown in color. The A2 horizon is 2 to 10 inches thick. The B horizon is clay loam or clay modified by stones or cobblestones. The content of coarse fragments ranges from 35 to 80 percent. Depth to overlapping flagstone ranges from 20 to 40 inches.

Sunshine loam, 5 to 35 percent slopes (SuE).—This soil is mainly in the Cochetopa and upper Blue Creek drainages. Included with it in mapping are small areas of Rock outcrop and Stony rock land and areas of Vulcan and Ruby soils. Included soils make up less than 10 percent of the total acreage.

Nearly all the acreage is in native vegetation and is used for grazing. This soil also provides habitat for deer and elk. Runoff is medium or rapid, and the erosion hazard is moderate or high. Capability unit VIe-4 nonirrigated; Subalpine Loam range site.

Tolvar Series

The Tolvar series consists of deep, well-drained soils on mountainsides and adjacent alluvial fans. Slopes are 10 to 50 percent. These soils formed in alluvium and colluvium weathered from granite.

Typically, these soils have a 4-inch mat of undecomposed and partly decomposed needles, bark, and twigs. In a representative profile the surface layer is dark grayish-brown gravelly coarse sandy loam about 2 inches thick. The subsurface layer is light-gray gravelly coarse sandy loam about 12 inches thick. The next layer, about 7 inches thick, is a mixture of reddish-brown and light-gray gravelly sandy clay loam. The subsoil is reddish-brown and brown very gravelly sandy clay loam and coarse sandy loam about 25 inches thick. The substratum to a depth of 60 inches is light yellowish-brown very gravelly coarse sandy loam.

Tolvar soils are at elevations of 8,500 to 10,000 feet. They receive more than 20 inches of annual precipitation. The average annual soil temperature is less than 38° F. The overstory vegetation is commonly Engelmann spruce, subalpine fir, and aspen. The understory is chiefly mountainash, common juniper, boxleaf myrtle, elk sedge, and bearberry.

Permeability is moderate, and available water capacity is moderate. Roots can penetrate to a depth of 60 inches or more.

These soils are used for timber production, wildlife, and watershed.

The Tolvar soils in this survey area are mapped only with Uinta soils.

Representative profile of Tolvar gravelly coarse sandy loam, 10 to 50 percent slopes; SW1/4 sec. 4, T. 46 N., R. 1 W., Saguache County:

O1—4 inches to 1 inch, undecomposed organic material consisting of needles, bark, and twigs.

O2—1 inch to 0, partly decomposed organic material.

A1—0 to 2 inches, dark grayish-brown (10YR 4/2) gravelly coarse sandy loam, very dark grayish brown (10YR 2/2) moist; strong, medium, granular structure; soft, very friable; 15 percent angular granitic gravel; pH 6.4; clear, smooth boundary.

A2—2 to 14 inches, light-gray (10YR 7/2) gravelly coarse sandy loam, grayish brown (10YR 5/2) moist; strong, medium, granular structure; soft, very friable; 30 percent fine and very fine, angular, granitic gravel; pH 6.0; gradual, irregular boundary.

A&B—14 to 21 inches, mixed colors including light-gray (10YR 7/2) and reddish-brown (5YR 5/4) gravelly sandy clay loam, grayish brown (10YR 5/2) and reddish brown (5YR 4/4) moist; weak, fine, subangular blocky structure; hard, very friable; seams and nodules of B2t material imbedded in a matrix of A2 material; thin patchy clay films on some ped faces; 40 percent fine and very fine, angular, granitic gravel; pH 6.2; gradual, irregular boundary.

B2t—21 to 40 inches, reddish-brown (5YR 5/4) very gravelly

sandy clay loam, reddish brown (5YR 4/4) moist; moderate, medium, subangular blocky structure; hard, very friable; thin continuous clay films on ped faces; 50 percent fine and very fine, angular, granitic gravel; pH 6.4; gradual, wavy boundary.

B3t—40 to 46 inches, brown (7.5YR 5/4) very gravelly coarse sandy loam, brown (7.5YR 4/4) moist; weak, medium, subangular blocky structure; hard, very friable; few, thin, patchy clay films on ped faces; 50 percent fine, angular, granitic gravel and cobblestones; pH 6.4; gradual, wavy boundary.

C—46 to 60 inches, light yellowish-brown (10YR 6/4) very gravelly coarse sandy loam, yellowish brown (10YR 5/4) moist; massive; hard, very friable; 50 percent angular granitic gravel and cobblestones; pH 6.4.

The A1 horizon is 0 to 4 inches thick. The A2 horizon ranges from light brownish gray or light gray to pinkish gray or pink. The B2t horizon is reddish-brown or light reddish-brown sandy clay loam that is 35 to 50 percent very fine and fine, angular, granitic gravel. The soil is slightly acid or medium acid. Bedrock is commonly below a depth of 40 inches.

Tongue River Series

The Tongue River series consists of moderately deep, well-drained soils on mountainsides. Slopes are 10 to 50 percent. The soils formed in colluvium that was derived from sandstone and interbedded shale.

Typically these soils have a 5-inch mat of undecomposed and partly decomposed needles, bark, and twigs. In a representative profile the surface layer is grayish-brown loam about 3 inches thick. The subsurface layer is about 10 inches of light-gray loam. Next is a 7-inch layer of brown and very pale brown sandy clay loam. The subsoil is brown and light olive-brown silty clay loam about 18 inches thick. Olive and buff sandstone interbedded with thin layers of shale is at a depth of 38 inches.

Tongue River soils are at elevations of 9,000 to 10,200 feet. They receive about 24 inches of annual precipitation. The average annual soil temperature is 36° F. The native vegetation is commonly Engelmann spruce, subalpine fir, lodgepole pine, and aspen. The understory is dominantly spike trisetum, elk sedge, boxleaf myrtle, alder, and common juniper.

Permeability is slow. Roots can penetrate to a depth of only about 36 inches, and available water capacity is low.

These soils are important for lumber, wildlife, and recreation.

Representative profile of Tongue River loam, 10 to 50 percent slopes; SE1/4 sec. 30, T. 15 S., R. 86 W., Gunnison County:

O1—5 to 2 inches, dark, twigs, and some leaves.

O2—2 inches to 0, partly decomposed organic material.

A1—0 to 3 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; strong, fine, crumb structure; soft, very friable; pH 6.4; clear, smooth boundary.

A2—3 to 13 inches, light-gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; weak, medium, subangular blocky structure parting to moderate, fine, granular; slightly hard, very friable; pH 6.4; gradual, wavy boundary.

A&B—13 to 20 inches, mixed colors ranging from very pale brown (10YR 7/3) and brown (10YR 5/3) sandy clay loam, brown (10YR 5/3) and dark brown (10YR 4/3) moist; moderate, medium, subangular blocky structure; slightly hard; very friable; seams and bands of B2t material interbedded in a matrix of A2 material; few, thin, patchy clay films on ped faces; pH 6.4; gradual, wavy boundary.

B2t—20 to 32 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; strong, medium, subangular blocky structure; hard, friable; thin nearly continuous clay films on ped faces; pH 6.4; clear, smooth boundary.

B3t—32 to 38 inches, light olive-brown (2.5Y 5/4) silty clay loam, olive brown (2.5Y 4/4) moist; weak, medium, subangular blocky structure; hard, very friable; few, thin, patchy clay films on ped faces; 20 percent weathered sandstone and shale gravel fragments throughout horizon; pH 6.4; gradual, wavy boundary.

R—38 to 60 inches, olive and buff sandstone interbedded with thin strata of shale.

The A2 horizon is typically loam or silt loam, but in places is stony silt loam. It is light gray or very pale brown and ranges from 5 to 15 inches in thickness. The B2t horizon ranges from brown or pale brown to light brownish gray or grayish brown. The soil is slightly acid or neutral. Sandstone interbedded with shale is at a depth of 20 to 40 inches.

Tongue River loam, 10 to 50 percent slopes (TrF).—This soil is mainly in the Crested Butte and Carbon Peak parts of the survey area. Included with it in mapping are small areas of Rock outcrop and Stony rock land, areas of Bead and Bogan soils, and small areas of Tongue River soils where slopes are 50 to 70 percent. Included soils make up 10 percent of the total acreage.

Almost all the acreage is forested, mainly with Engelmann spruce, subalpine fir, and aspen. Northern exposures are mainly in lodgepole pine. Runoff is medium or high, and the erosion hazard is high. Capability unit VIIe-2 nonirrigated; woodland group 4.

Uinta Series

The Uinta series consists of deep, well-drained soils on mountainsides. Slopes are 10 to 50 percent. These soils formed in locally transported alluvium and colluvium that were derived mainly from gneiss or schist.

Typically, these soils have a 4-inch mat of undecomposed and partly decomposed needles, bark, and twigs. In a representative profile the surface layer is light brownish-gray stony loam about 4 inches thick. The upper 14 inches of the subsurface layer is light-gray stony loam. The lower 7 inches is pink and reddish-brown stony clay loam. The subsoil is reddish-brown stony clay loam about 25 inches thick. The substratum to a depth of 60 inches is reddish-brown stony clay loam.

Uinta soils are at elevations of 8,500 to 10,000 feet. The average annual soil temperature is less than 42° F. The average annual precipitation is about 20 inches. The dominant vegetation is Douglas-fir, subalpine fir, and aspen trees and an understory of kinnikinnick, Oregongrape, and elk sedge.

Permeability is slow. The root zone is 60 inches deep or more, and available water capacity is moderate to high.

These soils are used for timber production, recreation, wildlife, and limited grazing.

Representative profile of Uinta stony loam, 10 to 50 percent slopes; SW1/4 sec. 12, T. 48 N., R. 1 E., Gunnison County:

O1—3 inches to 1 inch, undecomposed organic material, chiefly needles, bark, and twigs.

O2—1 inch to 0, partly decomposed organic material.
A1—0 to 4 inches, light brownish-gray (10YR 6/2) stony loam, dark grayish brown (10YR 4/2) moist; strong, fine, granular structure; soft, very friable; 15 percent stone and gravel; pH 6.2; gradual, smooth boundary.
A2—4 to 18 inches, light-gray (10YR 7/2) stony loam, grayish brown (10YR 5/2) moist; weak to moderate, fine, subangular blocky structure; soft, very friable; 15 percent stone and gravel; pH 6.0; gradual, wavy boundary.
A&B—18 to 25 inches, mixed pink (7.5YR 7/2) to reddish-brown (5YR 5/4) stony clay loam, brown (7.5YR 5/3) and reddish brown (5YR 4/4) moist; moderate, medium, subangular blocky structure; hard, friable; clayey nodules similar to B2t material embedded in light-colored matrix similar to A2 material; 15 percent gravel and stones; pH 5.8; diffuse, wavy boundary.
B2t—25 to 50 inches, reddish-brown (5YR 5/4) stony clay loam, reddish brown (5YR 4/4) moist; moderate, medium, subangular blocky structure; very hard, friable; thin nearly continuous clay films on ped faces; 25 percent stone and gravel; pH 5.0.
C—50 to 60 inches, reddish-brown (5YR 5/4) very stony clay loam, reddish brown (5YR 4/4) moist; massive; hard, friable; 50 percent stone and gravel; pH 5.0.

The A2 horizon is loam or stony loam and ranges from light gray or pale brown to pinkish gray. It is as much as 30 percent gravel and cobblestones. The B2t horizon ranges from brown to reddish brown. It is 15 to 35 percent angular coarse fragments. Gneiss or schist is commonly at a depth of 50 to 60 inches. Reaction ranges from slightly acid to very strongly acid.

Uinta and Tolvar soils, 10 to 50 percent slopes (UtF).—This mapping unit is mainly in the southern and eastern parts of the survey area. Each soil has the profile described as representative of its series. At lower elevations, these soils generally are on northern and eastern exposures. Small areas of these soils are in complex patterns on the landscape, but the larger areas are not generally associated geographically. The largest area of Uinta soil is in the southern part of the survey area between Cochetopa Creek and the Lake Fork of the Gunnison River. The Tolvar soil is mainly south of Powderhorn and in the Quartz Creek drainage area.

Included with these soils in mapping are small areas of Carbol, Cathedral, and Woosley soils. Also included, in the northern part of the survey area, are small areas of soils similar to Uinta soils that have a brown surface layer 6 to 10 inches thick and a loamy subsoil. Areas of Rock outcrop and Stony rock land are common. Included soils make up less than 15 percent of the total acreage.

Most of the acreage is forested and is used for timber, wildlife, recreation, and limited grazing. The main trees are Engelmann spruce, subalpine fir, Douglas-fir, and aspen. Burned-over and logged-over areas revert to aspen over a period of several years.

In this unit runoff is medium to rapid, and the erosion hazard is moderate to high. Use and management are about the same for both soils. Capability unit VIIe-2 nonirrigated; woodland group 2.

Vulcan Series

The Vulcan series consists of deep, well-drained soils on upland mesas and side slopes. Slopes are 10 to 55 percent. These soils formed in gravelly material weathered from rhyolite or rhyolitic tuff.

Typically these soils have a 4-inch mat of undecomposed and partly decomposed needles, bark, and twigs. In a representative profile the mineral surface layer is light-gray gravelly sandy loam about 17 inches thick. The next layer, about 9 inches thick, is reddish-brown and light-gray very stony and gravelly clay loam. The subsoil is about 10 inches of reddish-brown very stony and gravelly clay. Overlapping flagstone that has 1- to 2-inch voids is at a depth of 36 inches.

Vulcan soils are at elevations of 8,500 to 10,000 feet. The average annual precipitation is about 20 inches. The average annual soil temperature is 46° F. The native vegetation is commonly lodgepole pine, Engelmann spruce, Douglas-fir, and aspen. The understory is chiefly Oregongrape, kinnikinnick, elk sedge, and common juniper.

Permeability is slow. Roots can penetrate to a depth of only about 30 inches, and available water capacity is low.

These soils are used for timber production, recreation, and wildlife.

Representative profile of Vulcan gravelly sandy loam, 10 to 55 percent slopes; SW1/4 sec. 29, T. 47 N., R. 2 E., Saguache County:

O1—4 inches to 1 inch, undecomposed organic material, chiefly needles, bark, twigs, and leaves.
O2—1 inch to 0, undecomposed organic material like that of the horizon above.
A2—0 to 17 inches, light-gray (10YR 7/2) gravelly sandy loam, light brownish gray (10YR 6/2) moist; weak, thin, platy structure parting to moderate, fine, granular; soft, very friable; 35 percent gravel and stones; pH 6.2; clear, smooth boundary.
A&B—17 to 26 inches, mixed colored, including light-gray (10YR 7/2) and reddish-brown (10YR 5/4) very stony and gravelly clay loam, light brownish gray (10YR 6/2) and reddish brown (5YR 4/4) moist; moderate, fine, subangular blocky structure; slightly hard, very friable; seams and nodules of clayey B2t material imbedded in a light-colored matrix of A2 material; thin patchy clay films on ped faces of clayey material; 60 percent gravel and stones; pH 6.0; gradual, wavy boundary.
B2t—26 to 36 inches, reddish-brown (5YR 5/4) very stony and gravelly clay, reddish brown (5YR 4/4) moist; moderate, medium and fine, subangular structure; extremely hard, firm; thin continuous clay films on ped faces and thin clay coatings on the surface of rock fragments; 60 percent stones and gravel; pH 6.0; gradual, wavy boundary.
IIC—36 to 60 inches +, fractured rhyolite consisting of overlapping flagstones; voids 1 inch to 4 inches across not filled with soil material.

The A2 horizon is gravelly sandy loam, stony loam, or loam. It is light brownish gray or light gray. The B2t horizon ranges from reddish brown to brown and is medium to slightly acid. The content of angular gravel and stones in the B2t horizon ranges from 50 to 80 percent. Depth to overlapping flagstones is 20 to 40 inches.

Vulcan gravelly sandy loam, 10 to 35 percent slopes (VuE).—This soil is mainly in the southern and western part of the survey area and is most extensive in the Cochetopa Creek drainage. In old burned-over areas, which are now in aspen, a 1- to 2-inch, dark-gray surface layer is common.

Included with this soil in mapping are areas of Rock outcrop and Stony rock land. Also included are small areas of Uinta and Tolvar soils in the southeastern part of the survey area and areas of Shule soils in the west-

ern part. Included soils make up 15 percent or less of the total acreage.

The acreage is almost entirely forested. Tree species vary, depending on exposure and altitude, and include Douglas-fir, Engelmann spruce, aspen, and common juniper. Runoff is medium or rapid, and the erosion hazard is moderate or high. Capability unit VIIe-2 nonirrigated; woodland group 3.

Wetterhorn Series

The Wetterhorn series consists of moderately deep, well-drained soils on mountainsides and ridgetops. Slopes are 10 to 55 percent. These soils formed in local alluvium and colluvium that were derived from quartz latite or breccia.

Typically, these soils have a 3-inch mat of undecomposed and partially decomposed needles, bark, and twigs. In a representative profile the mineral surface layer is pinkish-gray stony loam about 12 inches thick. The next layer is mixed pinkish-gray and brown stony loam. The subsoil is brown stony clay loam about 16 inches thick. Partly weathered quartz latite is at a depth of 36 inches.

Wetterhorn soils are at elevations of 9,500 to 11,000 feet. They receive about 25 inches of annual precipitation. The average annual soil temperature is about 38° F. The vegetation is commonly Engelmann spruce, subalpine fir, and aspen.

Permeability is slow. Roots penetrate to a depth of 36 inches. Available water capacity is low.

These soils are used mainly for timber production, limited grazing, and wildlife.

Representative profile of Wetterhorn stony loam, 10 to 55 percent slopes; sec. 35, T. 46 N., R. 3 W., Gunnison County:

O1—3 inches to 1 inch, undecomposed mat of forest litter.
O2—1 inch to 0, partly decomposed mat of needles, bark, twigs, and leaves.
A2—0 to 12 inches, pinkish-gray (7.5YR 6/2) stony loam, brown (7.5YR 5/2) moist; weak, medium, platy structure parting to moderate, fine, granular; slightly hard, very friable; 25 percent angular stones and gravel; pH 6.0; gradual, wavy boundary.
A&B—12 to 20 inches, mixed pinkish-gray (7.5YR 6/2) and brown (7.5YR 5/3) stony loam, dark brown (7.5YR 4/2 and 7.5YR 4/3) moist; weak, medium, subangular blocky structure parting to moderate, fine, granular; slightly hard, friable; nodules of clayey B2t material imbedded in matrix of A2 material; 25 percent angular stones and gravel; pH 6.0; clear, wavy boundary.
B2t—20 to 36 inches, brown (7.5YR 5/4) stony clay loam, dark brown (7.5YR 4/4) moist; moderate, medium, subangular blocky structure parting to strong, fine, subangular blocky; extremely hard, firm; thin continuous clay films on ped faces; 30 percent angular stones and gravel; pH 6.0; clear, smooth boundary.
R—36 inches, partly weathered quartz latite bedrock.

The A2 horizon is typically stony loam, but in places is gravelly loam and loam. It ranges from light brownish gray or light gray to pinkish gray. The B2t horizon is brown or light-brown heavy clay loam or clay. The content of angular gravel and stones in the B2t horizon ranges from 5 to 35 percent. Bedrock is at a depth of 20 inches. Reaction is medium acid to neutral.

Wetterhorn stony loam, 10 to 55 percent slopes (WeF).—This soil is mainly in the south-central part of the survey area. Included with it in mapping are areas of Nutras and Shule soils; small areas of Vulcan, Uinta, and Tolvar soils at lower elevations; areas of Rock outcrop and Rockslides commonly at higher elevations; and small areas where slopes are less than 10 or more than 55 percent. Included soils make up less than 15 percent of the total acreage.

Almost all the acreage is forested and is used for timber production. Large areas are in second-growth timber. Areas destroyed by fire or heavily logged commonly revert to aspen within a few years. Deer and elk find food and concealment during the summer. Some roads have been constructed, but much of the area is still virtually inaccessible. Runoff is medium or rapid, and the erosion hazard is moderate or high. Capability unit VIIe-2 nonirrigated; woodland group 3.

Woodhall Series

The Woodhall series consists of moderately deep, well-drained soils on ridgetops, mountain spurs, and mountainsides. Slopes are 5 to 50 percent. These soils formed in locally transported stony and gravelly material weathered from rhyolitic tuff.

In a representative profile the surface layer is dark grayish-brown gravelly loam about 9 inches thick. The subsoil, about 21 inches thick, is brown very stony and extremely stony clay loam. Fractured rhyolite is at a depth of 30 inches.

Woodhall soils are at elevations of 8,500 to 10,000 feet. The average soil temperature is 42° F., and the annual precipitation is about 17 inches. The native vegetation is commonly ponderosa pine, Douglas-fir, and big sagebrush. Grasses are chiefly Indian ricegrass, mountain muhly, Arizona fescue, and wheatgrass.

Permeability is slow. Roots can penetrate to a depth of only about 30 inches, and available water capacity is low.

These soils are important for timber, grazing, and wildlife.

Representative profile of Woodhall gravelly loam near the center of sec. 1, T. 46 N., R. 3 W., Gunnison County:

A1—0 to 9 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) moist; weak, medium, granular structure parting to moderate, fine, granular; soft, very friable; 15 percent angular gravel; pH 7.0; clear, wavy boundary.
B2t—9 to 17 inches, brown (7.5YR 5/3) very stony clay loam, dark brown (7.5YR 4/3) moist; moderate, fine, subangular blocky structure; hard, firm; medium continuous clay films on ped faces; 50 percent stones, cobblestones and gravel; pH 6.8; gradual, wavy boundary.
B3t—17 to 30 inches, brown (7.5YR 5/3) extremely stony clay loam, dark brown (7.5YR 4/3) moist; weak, fine, subangular blocky structure; hard, firm; medium patchy clay films on ped faces and rock fragments; 90 percent stones, cobblestones, and gravel; pH 6.8; gradual, wavy boundary.
R—30 inches, fractured rhyolite.

The A horizon is typically gravelly loam, but in places is stony loam. It ranges from grayish brown to dark grayish brown. The content of coarse fragments in the B horizon is 50 to 80 percent. The B2t horizon ranges from brown to reddish brown. Reaction is slightly acid or neutral.

Woodhall extremely rocky loam, 5 to 50 percent slopes (WoF).—This mapping unit is about 55 percent Wood-

hall gravelly loam and 30 percent Rock outcrop and Stony rock land. It is in the southern part of the survey area. The largest areas are near Powderhorn and along the Lake Fork of the Gunnison River.

Included with this soil in mapping are small areas of Vulcan and Youman soils and small areas of Posant soils on the steeper slopes. Included soils make up less than 15 percent of the total acreage.

This soil is used for grazing and timber production. Livestock graze the area in summer, and deer and elk find food and concealment. Runoff is medium or rapid, and the erosion hazard is moderate or high. Capability unit VIIs-2 nonirrigated; woodland group 1.

Woosley Series

The Woosley series consists of moderately deep, well-drained soils on upland hillsides, ridges, and mountainsides. Slopes are 10 to 60 percent. These soils formed in calcareous material weathered from chlorite-schist or metagabbro.

In a representative profile the surface layer is grayish-brown stony loam about 5 inches thick. The subsoil, about 25 inches thick, is brown clay loam that is calcareous in the lower part. Weathered chlorite-schist is at a depth of about 30 inches.

Woosley soils are at elevations of 9,000 to 10,000 feet. The average annual precipitation is about 17 inches. The average annual soil temperature is 40° F., and the average soil temperature in summer is 54°. The native vegetation is commonly open stands of ponderosa pine and Douglas-fir. The understory is dominantly big sagebrush, Arizona fescue, needlegrass, and native bluegrass.

Permeability is slow. Roots can penetrate to a depth of only about 30 inches, and available water capacity is low.

These soils are used for timber production, grazing, recreation, and wildlife.

Representative profile of Woosley stony loam, 10 to 60 percent slopes, 2.8 miles southwest of the Cebolla Creek road; sec. 2, T. 45 N., R. 2 W., Gunnison County:

A1—0 to 5 inches, grayish-brown (10YR 5/2) stony loam, very dark grayish brown (10YR 3/2) moist; strong, very fine, granular structure; soft, very friable; 20 percent angular stones and gravel; pH 6.8; clear, smooth boundary.

B1t—5 to 10 inches, brown (10YR 5/3) stony light clay loam, dark brown (10YR 3/3) moist; moderate, meduim, subangular blocky structure parting to strong, medium, granular; slightly hard, very friable; thin patchy clay films on vertical surface of peds; 10 percent angular stones and gravel; pH 6.8; clear, smooth boundary.

B2t—10 to 19 inches, brown (7.5YR 5/3) clay loam, dark brown (7.5YR 4/3) moist; moderate, medium, subangular blocky structure; hard, friable; thin patchy clay films on both vertical and horizontal surfaces of peds; 10 percent angular gravel and stones; pH 7.5; clear, wavy boundary.

B3tca—19 to 30 inches, brown (10YR 5/3) light clay loam, dark brown (10YR 4/3) moist; weak, medium, subangular blocky structure; hard, friable; thin patchy clay films on vertical ped surfaces; 10 percent angular gravel and stones; calcareous; few, fine, distinct, white (10YR 8/2) mottles on lime segregations; pH 8.2; gradual, wavy boundary.

C—30 inches, olive to gray, weathered, calcareous chlorite-schist.

The A horizon is typically stony loam, but ranges from loam to very stony loam. It is 5 to 10 inches thick and ranges from brown to dark grayish brown or grayish brown. The content of angular gravel and stones in the B2t horizon ranges fom 5 to 35 percent by volume. This horizon is brown or light brown. Depth to weathered bedrock ranges from 20 to 40 inches. Woosley soils are typically calcareous in the lower part of the subsoil. Some areas are lime free.

Woosley very rocky loam, 10 to 60 percent slopes (WvF).—This mapping unit is about 55 percent Woosley stony loam and 30 percent Rock outcrop and Stony rock land. It is mainly in the Powderhorn part of the survey area on south-facing slopes.

Included with this soil in mapping are small areas of Carbol soils and areas of Uinta and Tolvar soils on northern exposures. Included soils make up less than 15 percent of the total acreage.

This unit is almost entirely in native vegetation. It is used chiefly for timber production. It is also grazed by livestock. Deer and elk often feed on the sunny slopes in winter. Runoff is medium or rapid, and the erosion hazard is moderate or high. Capability unit VIIe-2 nonirrigated; woodland group 1.

Youga Series

The Youga series consists of deep, well-drained soils on upland hillsides and mountainsides. Slopes are 3 to 30 percent. These soils formed in gravelly and cobbly glacial till and alluvial fan sediment.

In a representative profile the surface layer is very dark grayish-brown loam about 6 inches thick. The subsoil is dark-brown and brown gravelly clay loam about 23 inches thick. The substratum to a depth of 60 inches is pale-brown gravelly clay loam.

Youga soils are at elevations of 8,500 to 9,500 feet. They receive 20 inches of annual precipitation. The average annual soil temperature is 39° F. The vegetation is commonly Thurber fescue, bearded wheatgrass, nodding brome, big sagebrush, and scattered clumps of aspen.

Permeability is slow. Roots can penetrate to a depth of 60 inches or more, and available water capacity is high.

These soils are used for grazing and wildlife.

Representative profile of Youga loam, 3 to 30 percent slopes; NE1/4 sec. 7, T. 50 N., R. 2 E., Gunnison County:

A1—0 to 6 inches, very dark grayish-brown (10YR 3/2) loam, black (10YR 2/1) moist; weak, medium, subangular blocky structure parting to weak, fine, granular; soft, very friable; 5 to 10 percent cobblestones and stones; pH 6.7; clear, smooth boundary.

B1t—6 to 10 inches, dark-brown (7.5YR 4/3) gravelly light clay loam, dark brown (7.5YR 3/3) moist; moderate, medium, subangular blocky structure; hard, friable; thin patchy clay films on ped faces; 15 percent gravel and cobblestones; pH 6.7; clear, smooth boundary.

B2t—10 to 24 inches, brown (7.5YR 5/3) gravelly clay loam, dark brown (7.5YR 4/3) moist; moderate, medium, subangular blocky structure; very hard, firm; thin continuous clay films on ped faces; 15 percent cobblestones and gravel; pH 6.7; gradual, smooth boundary.

B3—24 to 29 inches, brown (7.5YR 5/4) gravelly light clay loam, dark brown (7.5YR 4/4) moist; moderate, medium, subangular blocky structure; hard, firm;

thin patchy clay films on ped faces; 20 percent gravel and cobblestones; pH 7.1; gradual, smooth boundary.

C—29 to 60 inches, pale-brown (10YR 6/3) gravelly light clay loam, dark brown (10YR 4/3) moist; massive; hard, friable; 30 percent gravel and cobblestones; pH 6.8.

The A horizon is typically loam, but in places is gravelly and cobbly. The B2t horizon is clay loam that is 10 to 30 percent gravel and cobblestones.

Youga loam, 3 to 30 percent slopes (YgE).—This soil is mainly in the northern part of the survey area, ordinarily on northern exposures.

Included with this soil in mapping are small areas of Parlin and Mergel soils at lower elevations and small areas of eroded Youga soils. Included soils make up 10 percent of the total acreage.

This soil is used extensively for grazing and for wildlife. Runoff is medium, and the erosion hazard is moderate. Capability unit VIe-4 nonirrigated; Subalpine Loam range site.

Youman Series

The Youman series consists of deep, well-drained soils on alluvial fans and valley-fill slopes. Slopes are 5 to 35 percent. These soils formed in alluvial sediment that was derived from rhyolite and rhyolitic tuff.

In a representative profile the surface layer is very dark gray loam about 12 inches thick. The subsoil is brown and reddish-brown heavy clay loam about 28 inches thick. The substratum to a depth of 60 inches is light-brown heavy clay loam.

Youman soils are at elevations of 9,000 to 10,500 feet. They receive approximately 20 inches of annual precipitation. The average annual soil temperature is 38° F. The vegetation is commonly Thurber fescue, big bluegrass, Idaho fescue, big sagebrush, and scattered clumps of aspen.

Permeability is slow. Roots can penetrate to a depth of 60 inches or more, and available water capacity is high.

These soils are mainly on Blue Mesa and in the upper Pine Creek drainage. They are used principally as range and wildlife habitat.

The Youman soils in the Gunnison Area are mapped only with Leaps and Passar soils.

Representative profile of Youman loam, 5 to 30 percent slopes; SW1/4 sec. 21, T. 47 N., R. 4 W., Gunnison County:

A1—0 to 12 inches, very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; moderate, fine, granular structure; soft, very friable; pH 6.2; clear, smooth boundary.

B1t—12 to 17 inches, brown (7.5YR 5/3) clay loam, dark brown (7.5YR 4/3) moist; strong, very fine, subangular blocky structure; slightly hard, very friable; thin patchy clay films on ped faces, some bleached sand and silt grains on ped faces; pH 6.4; clear, smooth boundary.

B2t—17 to 35 inches, reddish-brown (5YR 5/3) heavy clay loam, reddish brown (5YR 4/3) moist; moderate, medium, angular blocky structure parting to strong, fine, angular blocky; extremely hard, firm; thin continuous clay films on ped faces; pH 6.4; gradual, smooth boundary.

B3t—35 to 40 inches, light reddish-brown (5YR 6/4) heavy clay loam, reddish brown (5YR 5/4) moist; moderate, coarse, subangular blocky structure; extremely hard, firm; thin patchy clay films on ped faces; pH 7.0; gradual, smooth boundary.

C—40 to 60 inches, light-brown (7.5YR 6/4) heavy clay loam, brown (7.5YR 5/4) moist; weak, coarse, angular blocky structure; extremely hard, very firm; pH 7.0.

The A horizon is typically loam, but in places is stony. It ranges from 6 to 15 inches in thickness and from very dark gray to black in color. The B2t horizon is typically heavy clay loam, but ranges to clay in places. The content of angular coarse fragments is as high as 30 percent in the lower part of the subsoil and in the substratum.

Youman-Leaps loams, 5 to 35 percent slopes (YlE).—This mapping unit is about 60 percent Youman soil and 30 percent Leaps soil. It is on uplands, mainly in the extreme west-central part of the survey area. The Leaps soil is along narrow, winding valleys and on toe slopes. It has a profile similar to the one described as representative of the Leaps series, but the surface layer is loam. The Youman soil is on somewhat rounded knobs and roughly parallel ridges.

Included with these soils in mapping are 2- to 5-acre tracts of Kubler and Dollard soils on dry southerly exposures. Small kames and kettles, typical of glaciated terrain, are scattered throughout this mapping unit. Included soils make up about 10 percent of the total acreage.

This unit is in native range and is used for livestock grazing and wildlife. Runoff is medium to rapid, depending on the slope. The erosion hazard is high on the Leaps soil and moderate on the Youman soil. Capability unit VIe-4 nonirrigated; Youman soil in Subalpine Loam range site, Leaps soil in Deep Clay Loam range site.

Youman-Passar loams, 5 to 30 percent slopes (YpE).—This mapping unit is about 55 percent Youman soil and 30 percent Passar soil. It is on uplands, mainly in the southern and western parts of the survey area. The Youman soil is on fans and valley-fill slopes. The Passar soil is commonly in higher positions along ridgetops.

Included with the soils in mapping are small areas of Parlin and Ruby soils, commonly on south and west exposures, and areas of eroded Youman and Passar soils. Also included are areas of Rock outcrop and Stony rock land along the edges of small mesas and on ridgetops and areas of Alluvial land, wet, in small drainageways and depressions. Included soils make up about 15 percent of the total acreage.

All the acreage is in native vegetation and is grazed by livestock. Deer and elk often feed in the area in summer. Runoff is medium to rapid and the erosion hazard is moderate or high. Capability unit VIe-4 nonirrigated; Subalpine Loam range site.

Use and Management of the Soils

This section suggests management of the soils of the Gunnison Area for meadow hay and pasture grasses. It explains the capability classification, used by the Soil Conservation Service, in which the soils are grouped according to their suitability for crops. It defines the capability groups in the Gunnison Area and describes

management by capability units. It also shows estimated yields of meadow hay on the soils under irrigation.

This part of the survey also contains information on range management and on the suitability of the soils for woodland and selected recreational uses. It also reports estimates and interpretations of soil properties that affect highway construction and other engineering structures.

Use of the Soils for Pasture and Hay[2]

About 40,000 acres in the survey area is irrigated pasture and meadow. Though this acreage is not large, it is the essential part of the ranching business. Hay is needed as livestock feed through the winter. The meadows are used as feeding areas in winter and furnish grazing early in spring and late in fall, when the range is dormant. Cattle are marketed in fall after grazing the meadows.

Inadequate management is the principal consideration on this pasture and meadow acreage. It results in the inefficient use of irrigation water and low yields of hay and pasture. Managing irrigation water is most important in improving or maintaining yields. Most of the hay and meadow in the Gunnison Area can be irrigated by corrugations, or small furrows, or by controlled flooding from gradient laterals, or contour ditches, at intervals down the slope. Any type of "on-off" irrigation is superior to the continuous wild flooding that is practiced on some meadows. Between irrigations the soil has a chance to aerate and warm up, which encourages the growth of better quality plants. Irrigation water is commonly taken from adjacent cold mountain streams. This water keeps the soil at a temperature that is too cool for optimum plant growth. Good water management and fertilization improve the plant composition of the pastures and meadows and increase yields.

Permanent structures for water control are needed to facilitate water management. Supply canals are commonly on mountain slopes, and in many the water loss is high. Control structures in the past were constructed of wood. New structures are made of more permanent material. Concrete or metal diversions and turnout structures are durable and are easy to install and use. Some reservoirs for irrigation water have been constructed to store the heavy flow during the spring snowmelt. They prevent some flooding, provide water for irrigation late in summer, and make better irrigation methods practical.

Removing excess surface or subsurface water from the soil is desirable in maintaining pasture species and improving production. Open ditches are constructed to intercept underground water. They are designed for the installation of water control structures that raise or lower the water table as needed during the irrigation season. Areas that pond when flooded or irrigated can be improved by constructing shallow surface ditches or by land leveling.

Fertilizing pasture and meadow along with proper water management increases production. Moderate applications of nitrogen and phosphate fertilizers give good results. The soils have a potential nitrogen supply from the action of soil bacteria, but because the soil temperature is cool, bacterial action is very slow and the supply of available nitrogen is low. Phosphorus increases or at least maintains the vigor of legumes in meadows or pastures.

Normal methods of plowing and disking for seedbed preparation on existing meadows and pastures are limited because the climate is cool and the sod decomposes slowly. Reseeding pasture and hay in the survey area is commonly limited to interseeding desirable species, such as alsike or red clover, brome, and meadow foxtail, into existing meadows. In areas where a thin organic layer is at the surface, meadows can be improved by chiseling or subsoiling and then interseeding.

Managing pasture and meadow to maintain high quality forage is needed for maximum production. Irrigated pasture is grazed during the summer. After hay is harvested (fig. 7), the regrowth or aftermath is also grazed.

Grass and grass-legume mixtures for hay or pasture require proper use and management. The height of the vegetation commonly determines when a pasture is ready for grazing or rotation and when grazing should be stopped. A 4-inch growth before grazing and a 3-inch stubble at all times help maintain good productive plants and reduce thinning of the stand and the possibility of winterkilling. A 3-inch stubble also helps prevent erosion and distribute irrigation water. Land leveling to remove surface undulations is generally limited because the soils are shallow over gravel, have an organic surface layer, or have excessive slopes. The cost of land leveling is also a limiting factor.

Weed control is a problem in some irrigated areas. Wild caraway, wild iris, and Canada thistle, common in some meadows and pastures, reduce the quality and quantity of forage. Dragging pastures and meadows to scatter manure promotes uniform grazing and plant growth.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification (*6*) can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, the kinds of soil are grouped at three levels: the capability class, the subclass, and

[2] EDWIN P. ENGLE, district conservationist, Soil Conservation Service, helped prepare this section.

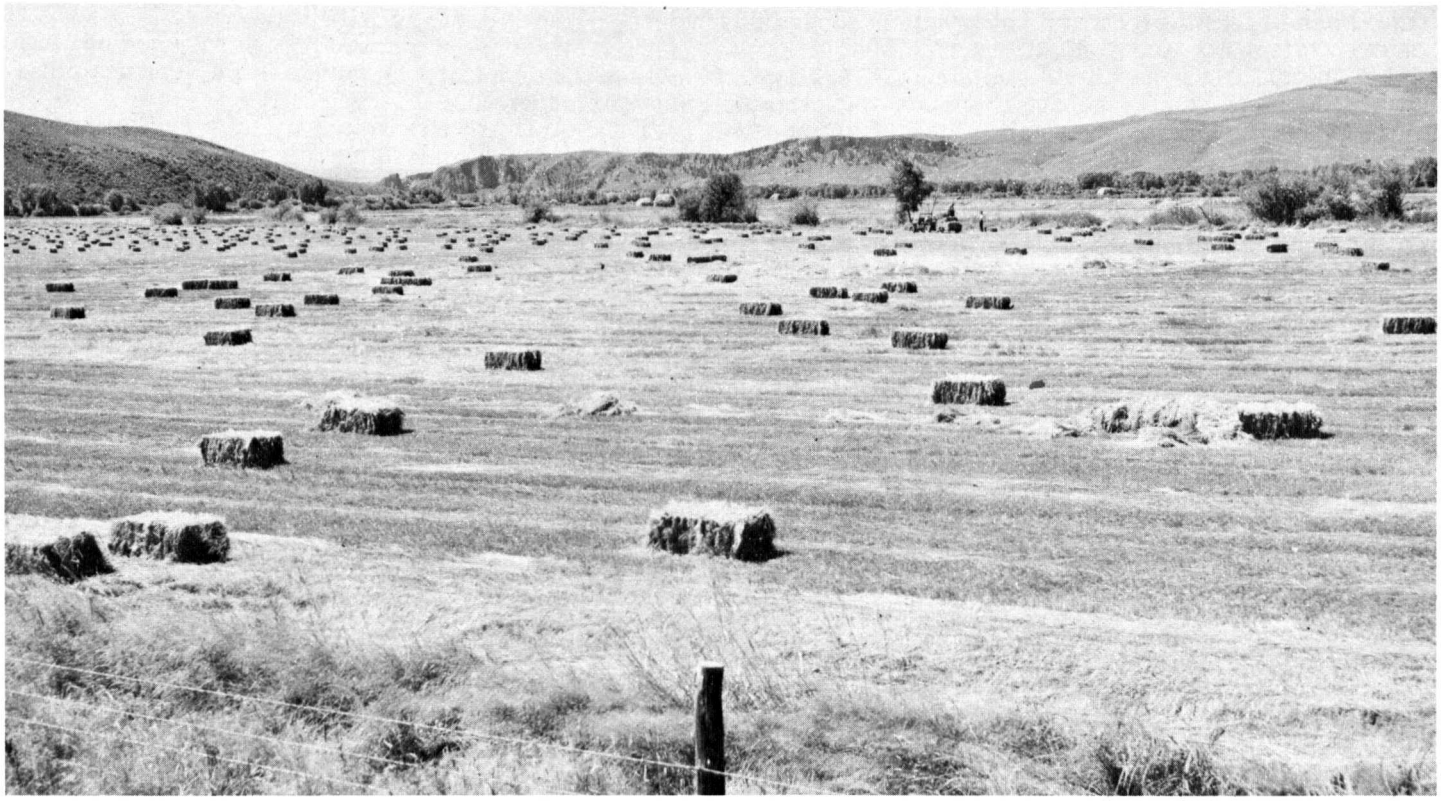

Figure 7.—**Bales of native hay on Irim loam, 0 to 1 percent slopes.**

the unit. These levels are described in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use. (None in the Gunnison Area.)

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices. (None in the Gunnison Area.)

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both. (None in the Gunnison Area.)

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both. (None in the Gunnison Area.)

Class V soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture or range, woodland, or wildlife.

Class VI soils have severe limitations that make them generally unsuitable for cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuitable for cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial crop production and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture or range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar

productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, Vc-1 or VIe-3. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages the capability units in the Gunnison Area are described and suggestions for the use and management of the soils are given. Capability unit numbers generally are assigned locally.

Management by capability units

In the following pages each of the capability units in the Gunnison Area is described, and the use and management of each unit are suggested. Some soils are irrigated for the production of hay and pasture crops. Other soils are nonirrigated and are used for grazing or woodland. If a soil is both irrigated and used for range, it requires different management. For this reason the soil is assigned to both an irrigated and nonirrigated capability unit. To find the names of all the soils in any given capability unit, refer to the "Guide to Mapping Units" at the back of this survey.

CAPABILITY UNIT Vw-1, IRRIGATED

This unit consists of dark-colored, poorly drained, nearly level soils on flood plains adjacent to stream channels. These soils have a moderately coarse textured and medium-textured surface layer and contain an appreciable number of rock fragments. Gleying and mottling are common. In most places a thin mat of partly decomposed plant residue at the surface makes revegetation difficult. The water table fluctuates and is at or near the surface during some part of the year.

These soils are subject to flooding almost every year. Irrigation is needed late in the growing season when the water table is low and floods are infrequent. Available water capacity is low to high, and permeability is slow to moderate.

These soils are well suited to meadow hay and irrigated pasture. Water-tolerant grasses and legumes grow well. Meadow foxtail, reed canarygrass, slender wheatgrass, alsike or red clover, and other water-tolerant species can be seeded and interseeded. Control of the water table is needed for good plant growth. Drainage is sometimes difficult because the soils are low along the stream channels and adequate outlets are scarce. Good management of irrigation water and maintenance of soil fertility are needed.

CAPABILITY UNIT Vw-2, IRRIGATED

This unit consists of very dark colored, somewhat poorly drained and poorly drained, gently sloping soils on flood plains. These soils have a moderately coarse textured and medium textured surface layer and contain an appreciable number of rock fragments. Gleying and bright-colored rust mottling are common. In most places a thin organic mat, 1 inch to 3 inches thick, is at the surface. The water table fluctuates between the surface and a depth of 3 feet.

These soils are subject to occasional flooding. Available water capacity is low to high. Permeability is slow to moderate.

These soils are well suited to meadow hay and irrigated pasture. Maintaining the water table at an optimum level for plant growth is the chief management concern. Good management of irrigation water is essential. Grade ditches, shallow drains, and land smoothing are needed to control the water table and to manage irrigation water. Renovation, seeding, and fertilization insure good quality hay and maximum yield. Alta fescue, meadow foxtail, timothy, and red and alsike clovers are the species seeded and interseeded.

CAPABILITY UNIT Vw-3, IRRIGATED

Only one soil, Gold Creek silty clay loam, 0 to 5 percent slopes, is in this unit. It is a deep, dark-colored, poorly drained, alkali-affected soil on flood plains. In most places a 1- to 2-inch organic mat is at the surface. The surface layer is calcareous, moderately alkaline silty clay loam that is mottled in the lower part. Very gravelly and cobbly sand is below a depth of 40 inches. In most areas the water table is at a depth of 1 to 2 feet during most of the growing season.

Maintaining the water table at an optimum level for plant growth and removing excess salts to levels that permit maximum production are the chief management concerns. Leaching excess salts is difficult because permeability is slow and the water table is high. In areas where drainage is practical, or during periods when the water table is low, heavy irrigation removes salts from the root zone and increases production.

Grasses tolerant of salts, alkali, and water, such as tall wheatgrass, tall fescue, and alkali sacaton, are best suited to this soil. Efficient irrigation and good pasture management are essential. Some land smoothing is needed to remove surface irregularities for better control of irrigation water. The best irrigation method is controlled flooding and contour supply ditches.

CAPABILITY UNIT Vc-1, IRRIGATED

This unit consists of moderately deep to deep, well-drained, gently sloping soils on terraces and alluvial fans. The surface layer of these soils is medium textured and moderately coarse textured. Lime-cemented cobblestones are commonly at a depth of 20 to 40 inches. In irrigated areas a 1- to 3-inch mat of partly decomposed organic material is commonly at the surface. This mat forms because the decomposition of organic matter is slow in the cool climate of the survey area.

Available water capacity is moderate to high. Permeability is moderate to slow. An excessive application of irrigation water commonly creates a temporary water table that encourages the growth of less desirable vegetation, such as sedges and rushes.

If well managed, these soils are productive and sustain high yields of meadow hay and pasture. A short growing season restricts their use for most other crops. Irrigation water must be carefully controlled or erosion can result. Land smoothing and improving the irrigation system facilitate the management of irrigation water. Depleted hay and pasture fields can be reseeded

and renovated. Hay and pasture plants respond well to fertilization and water management. Timothy, brome, intermediate wheatgrass, and alsike, red, and Ladino clovers are the species seeded and interseeded.

CAPABILITY UNIT VIe-1, IRRIGATED

This unit consists of deep and moderately deep, well-drained, moderately sloping to steep soils on alluvial fans, mountainsides, and hillsides. These soils have a medium textured and moderately fine textured surface layer. Lime layers are common below the subsoil. Bedrock is at a depth of 20 to 40 inches in the moderately deep soils. Scattered stones or cobblestones occur in some of the soils and are commonly concentrated in localized areas.

These soils are subject to water erosion, low temperature, and low precipitation. Available water capacity is low to high. Permeability is slow to moderate.

These soils are suited to native hay, and to irrigated pasture where water is available. Suitable pasture and hay plants are smooth brome, timothy, orchardgrass, intermediate wheatgrass, and red, alsike, and Ladino clovers. In establishing a new stand of grass, extra care must be taken in plowing to prevent excessive erosion. If the soils are not to be seeded to hay or pasture for a year or more, a small grain crop should be seeded to provide a protective cover. Irrigation ditches should be constructed on the contour. Supply ditches should have drop structures to minimize ditch erosion. Short irrigation runs and small flow in the runs keep erosion at a minimum.

Good pasture management is important when these soils are used for grazing. Maintaining good grasses and legumes, carefully managing irrigation water, and maintaining fertility increase production and limit the amount of erosion and deterioration.

CAPABILITY UNIT VIw-1, IRRIGATED

Only Alluvial land, wet, is in this capability unit. It is deep, dark colored, very poorly drained, stratified, and moderately coarse textured to moderately fine textured and contains numerous stones and cobblestones. It is in narrow winding valleys and on flood plains and receives water from springs and stream flow. The water table is at or near the surface during most of the year. Slopes are 0 to 5 percent.

Alluvial land, wet, is used for grazing and wildlife, but in some areas it is too wet for livestock. It cannot be plowed and seeded, because the water table is high. Removing excess water from shallow depressions and basins through furrows helps control the water table and promotes the growth of better grasses and clover. Erosion is not a hazard.

CAPABILITY UNIT VIs-1, IRRIGATED

This unit consists of deep, gently sloping to moderately sloping, cobbly and gravelly soils on terraces and alluvial fans. The surface layer of these soils is gravelly and cobbly sandy loam or cobbly loam. Very cobbly or very gravelly material is below a depth of 19 inches.

Available water capacity is low. Permeability is moderate to rapid. The erosion hazard is none to slight.

About half the acreage is irrigated and is suited to pasture or hay. Maintaining a good plant cover is difficult during periods of drought. Cultivating is difficult because the surface layer is cobbly or gravelly. Renovation is needed in places to establish desirable vegetation. The principal management concern is maintaining adequate moisture and an adequate supply of plant nutrients. Light, frequent irrigation and short runs are needed to prevent loss of water through deep percolation.

CAPABILITY UNIT VIe-2, NONIRRIGATED

This unit consists of deep, well-drained, gently sloping to moderately sloping soils that are mainly on alluvial fans and valley-fill slopes. The surface layer of these soils is medium textured to moderately coarse textured. In some areas it is gravelly, cobbly, or channery.

These soils are subject to water erosion unless protected. Available water capacity is low. Permeability is moderate to slow.

Most of the acreage is in native vegetation and is used for grazing. In some areas range seeding or interseeding is desirable. Equipment can be used in all areas. Grazing management should be carefully considered to maintain the most desirable grass species.

CAPABILITY UNIT VIe-4, NONIRRIGATED

This unit is in that part of the survey area where the annual precipitation is about 20 inches. It consists of moderately deep to deep, well-drained, gently sloping to moderately steep soils on uplands. These soils have a surface layer of loam or silt loam. Some are moderately deep over bedrock.

These soils are subject to erosion. Available water capacity is low to high, depending on depth to bedrock. Permeability is moderate to slow.

Most of the acreage is in native vegetation. Potential forage production is high under good grazing management. Seeding to replenish depleted areas is desirable. Mechanical equipment can be used in most areas. Controlling big sagebrush, silver sagebrush, and other undesirable vegetation, by the use of herbicides, for example, increases the vigor and amount of the understory grasses.

CAPABILITY UNIT VIe-5, NONIRRIGATED

This unit consists of moderately sloping to steep, well-drained soils on uplands. These soils are shallow and moderately deep over bedrock. The surface layer is medium textured and moderately coarse textured. Small angular pebbles and larger channery fragments are in the surface layer and throughout most of the soil.

Water erosion is a hazard. Available water capacity is low. In most places permeability is moderate.

Most of the acreage is used for grazing. Seeding to reestablish depleted forage species is desirable. Mechanical equipment can be used in preparing seedbeds and in seeding. Herbicides are used to control big sagebrush and other undesirable plants, in order to increase grass production.

Good grazing management is needed to maintain desirable vegetation and reduce erosion. Grazing should

be deferred in spring until the plant cover is adequate. Rotation grazing is needed during the growing period.

CAPABILITY UNIT VIw-3, NONIRRIGATED

Only Alluvial land is in this unit. It is deep, well drained, and nearly level to strongly sloping and is in narrow, winding valleys and on small fans and valley-fill toe slopes. The upper part is typically medium textured. The lower part is highly stratified. Flooding and gully erosion along drainageways are the main limitations.

Most of the acreage is in native vegetation and is used for grazing. Potential production is high because Alluvial land receives additional moisture as runoff from higher soils. Good grazing management is essential for maximum production and erosion control.

CAPABILITY UNIT VIIe-1, NONIRRIGATED

This unit consists of moderately sloping to steep, well-drained soils that are moderately deep to deep over bedrock. These soils are on uplands. The surface layer is silty clay loam. Permeability is slow, and available water capacity is high.

These soils are well suited to range. They should not be seeded because runoff is rapid and erosion is a hazard. If well managed, they produce moderate to high yields of forage. Deferred grazing, rotation grazing, and proper range use are needed to prevent depletion of the plant cover.

CAPABILITY UNIT VIIe-2, NONIRRIGATED

This unit consists of moderately deep to deep, strongly sloping to very steep, well-drained soils on hills and uplands. The surface layer of these soils is medium textured to moderately coarse textured and in places is gravelly or stony. The content of stones and gravel in the soil is high. Rock outcrop is common in some areas.

These soils receive more than 20 inches of annual precipitation, much of which is snow. Available water capacity is low to high. Permeability is slow to moderate.

The vegetation is dominantly Engelmann spruce, subalpine fir, Douglas-fir, and lodgepole pine. Aspen is dominant in most areas where the commercial trees have been destroyed by fire, logging, or some other means. Aspen will gradually be replaced by conifers if a seed source is available.

Stones, rocks, and steep slopes are moderate to severe limitations to the use of equipment. Good timber management is needed to protect these soils from erosion and to maintain productive stands. The erosion hazard is moderate or high, depending on slope, in those areas disturbed by fire, poor logging methods, and improper road construction. Some good trees should remain after cutting or harvesting as a seed source and for future harvest.

In places the understory vegetation is used for grazing.

CAPABILITY UNIT VIIs-3, NONIRRIGATED

This unit consists of well-drained and excessively drained, moderately sloping to very steep soils that are shallow to deep over bedrock. These soils are on uplands. The surface layer is medium textured and moderately coarse textured and is gravelly, channery, or stony. Rock outcrop is common in some areas.

Available water capacity is low to high, and permeability is moderately slow or moderate. In most places water erosion is a moderate to high hazard. Wind erosion can be a slight hazard on southern and western exposures.

Nearly all the acreage is in native vegetation and is used for grazing. Improving and maintaining the present vegetation are important. In most places the soils are too rocky, too steep, and too erodible for seeding. If necessary, mechanical equipment can be used in the less sloping, less stony areas.

Good grazing management is needed to maintain the most desirable vegetation and to prevent loss of soil through erosion. Grazing can be deferred early in spring until after plants have made sufficient growth.

CAPABILITY UNIT VIIw-4, NONIRRIGATED

Only Alluvial land, occasionally flooded, is in this unit. It is nearly level or gently sloping and varies widely in color, texture, depth, and drainage. It is on the flood plain and is subject to flooding and channel change. Very cobbly areas are interspersed with deeper soil material.

Alluvial land, occasionally flooded, is not suitable for cultivation. It can be used for limited grazing, wildlife, and recreation. Erosion can be a hazard, but the most serious limitations are overflow and detrimental deposition of silt, sand, and gravel. Drainage is not practical.

CAPABILITY UNIT VIIs-1, NONIRRIGATED

This unit consists of shallow to deep, well-drained, moderately sloping to very steep soils on uplands. The surface layer of these soils is loam and fine sandy loam and in most places is stony or cobbly.

Permeability is rapid to slow. In most places available water capacity is low, but in some it is high.

Nearly all the acreage is in native vegetation and is used for grazing.

These soils are so steep and have so many stones and cobblestones in the surface layer that seeding them is not feasible. Grazing should be deferred early in spring until the grass cover is adequate. Rotation grazing insures growth of the more desirable plants and improves forage production.

CAPABILITY UNIT VIIs-2, NONIRRIGATED

This unit consists of well-drained, strongly sloping to very steep soils on mountainsides and hillsides, generally on southerly and westerly exposures. These soils have a moderately coarse textured and medium-textured surface layer that is gravelly, channery, or stony. They are shallow to moderately deep over bedrock. Rock outcrop is common.

Permeability is moderate and moderately rapid, and available water capacity is low. The erosion hazard is moderate or high. The root zone is shallow, and an adequate vegetative cover is difficult to maintain. Snowmelt early in spring often results in deficient moisture for plants during the growing season.

Most of the acreage is in native vegetation and is used for timber and limited grazing. The dominant vegetation is ponderosa pine and Douglas-fir and an understory of Arizona fescue, mountain muhly, and big sagebrush. Suitability for timber is poor. Stones and rocks moderately to severely limit the use of equipment in harvesting timber. Steep slopes severely limit roadbuilding and skidding.

This unit is well suited to recreation and wildlife. Trees should be protected from fire, disease, and insects. The timber should be harvested when usable. Grazing should be controlled to keep erosion at a minimum.

CAPABILITY UNIT VIIs-3, NONIRRIGATED

The one soil in this unit, Meredith very stony loam, 8 to 50 percent slopes, is a deep, strongly sloping to very steep, well-drained soil on high mountainsides and rims above timberline.

Available water capacity is low, and permeability is moderate. The erosion hazard is high.

Revegetation is not feasible because the soil is too steep and stony, and the soil temperature is too cold.

The existing vegetation must be carefully managed to keep erosion at a minimum and to maintain vigorous growth.

CAPABILITY UNIT VIIIs-1, NONIRRIGATED

Only Rock outcrop is in this unit. It is more than 90 percent exposed bedrock. It is used principally by wildlife. It also has some scenic value.

CAPABILITY UNIT VIIIs-2, NONIRRIGATED

Only Rockslides is in this unit. It consists of loose angular rock fragments that range from small angular pebbles to boulders many feet thick. It is typically on steep upland slopes below cliffs and rimrocks.

Rockslides is valuable in maintaining water yields. It absorbs runoff after heavy rainfall and thus allows a more even distribution of water to springs and streams below. It also slows down runoff from snowmelt because the ice and snow that accumulate between the rocks melt more slowly during spring thaw.

CAPABILITY UNIT VIIIs-3, NONIRRIGATED

Only Stony rock land is in this unit. It consists of exposed bedrock, loose stones, and layers of soil material that are very shallow over bedrock interspersed with pockets of deeper soil material.

Stony rock land is best suited to wildlife and recreation. Deer and elk find concealment in these areas and often feed on the sunny slopes in winter.

Predicted yields on irrigated soils

Table 2 lists the predicted yields of meadow hay for the principal soils under irrigation and other improved management practices. The estimates are based on interviews with farmers and on records from agencies that deal with production.

Under improved management—

1. Irrigation water is applied intermittently, as indicated by plant and soil requirements.
2. Nitrogen and phosphate fertilizers are applied.
3. The more productive species, such as timothy, brome, orchardgrass, meadow fescue, and clover, are interseeded.
4. Surface drainage is provided to remove excess water.
5. Drainage is installed in the poorly drained soils to lower the water table and keep it at a constant level.

TABLE 2.—*Predicted average yields per acre under improved management on principal irrigated soils*

Soil	Meadow hay
	Tons
Big Blue loam, 0 to 1 percent slopes	3.5
Big Blue loam, 1 to 5 percent slopes	3.5
Bosler sandy loam, 1 to 8 percent slopes	3.5
Curecanti gravelly loam, 1 to 8 percent slopes	3.0
Dewville loam, 1 to 5 percent slopes	4.0
Dewville loam, 5 to 15 percent slopes	3.0
Evanston loam, 1 to 5 percent slopes	4.0
Evanston loam, 5 to 20 percent slopes	3.0
Fola cobbly sandy loam, 1 to 8 percent slopes	3.0
Gas Creek sandy loam, 0 to 1 percent slopes	2.5
Gas Creek sandy loam, 1 to 5 percent slopes	2.0
Gateview cobbly loam, 2 to 8 percent slopes	3.5
Gold Creek silty clay loam, 0 to 5 percent slopes	3.0
Irim loam, 0 to 1 percent slopes	3.5
Irim loam, 1 to 5 percent slopes	3.5

Use of the Soils for Range[3]

The Gunnison Area is characterized by rolling hills and very steep, mountainous range country interspersed with alluvial fans, terraces, mesas, and many drainageways. Some drainageways are in deep canyons that have steep to very steep sides or sheer cliffs.

Below an elevation of about 8,500 feet, Dry Mountain Loam is the most important and the dominant range site. It is associated with several other sites and with areas of woodland, very steep slopes, and Rock outcrop. In the Cochetopa Park area the Mountain Outwash site is dominant. At elevations of 8,300 to 9,300 feet, Mountain Loam is the most important site. At elevations of about 9,300 to 11,000 feet, Subalpine Loam is the most important site. In the northern part of the survey area, this site is at an elevation of about 8,700 feet. It occurs as open parks where the vegetation is dominantly Engelmann spruce, Douglas-fir, and aspen. The only range site above timberline is Alpine Slopes.

Nearly all range in the survey area is grazed by cattle. Only a small part, mainly the Alpine Slopes site, is grazed by sheep. A large part of the range is publicly owned and is administered by the Bureau of Land Management.

Range sites and condition classes

A range site is a distinctive kind of range that has a certain potential for producing range plants. Each site has its own combination of environmental conditions

[3] FORREST C. MAHAFFEY and T. K. EAMAN, range conservationists, Soil Conservation Service, helped prepare this section.

and characteristic plant community. The range site retains its ability to produce this potential plant community unless it is materially altered or the environment changes. Its inherent productivity, like that of other agricultural land, depends on the combined effects of the soil and the climate.

The range site is the basic unit of range for which management is determined. In order to determine the management needed, the user of range must know the kind and quantity of range plants on the individual sites and determine the condition of each site by comparing the present plant cover with the potential, or original, plant community. The purpose of determining range condition is to measure any deterioration that has taken place and to provide a basis for predicting the degree of improvement possible. Range condition is expressed in terms of condition classes. Four condition classes are recognized.

A range is in *excellent* condition if 76 to 100 percent of the present vegetation is of the same kind as the potential plant community. It is in *good* condition if the percentage is 51 to 75 percent, in *fair* condition if the percentage is 26 to 50, and in *poor* condition if the percentage is less than 25.

To determine range condition, or the degree to which the present plant composition has departed from that of the native potential plant community, an estimate is made of the relative production, by weight, of the species that make up the plant community. Range plants differ in their response to different kinds of grazing on specific range sites. They are identified accordingly as decreasers, increasers, or invaders.

Livestock graze selectively and generally graze the more palatable plants first. Continued heavy grazing gradually reduces the relative abundance of the more palatable plants. These plants are *decreasers*. Generally they are perennials and the dominant species in the potential plant community. The percent by weight of all decreasers is included in determining range condition.

Increasers are the plants in the potential plant community that commonly increase in abundance and replace the decreasers when the range is grazed heavily. Only that percent by weight of increaser plants in the natural potential plant cover is counted in determining range condition.

Under continued heavy grazing, the increasers decline and the site is invaded by woody plants, herbaceous annuals and perennials, exotics, or plants native to some other range site.

The management essential in maintaining or improving the vegetation on all range sites increases the abundance of the best native forage plants. Experience and research show that if only about half of the air-dry weight of key forage plants is removed by grazing, range condition does not deteriorate. A well-planned grazing system provides a periodic rest during the growing season. Brush control is important.

Descriptions of range sites

The nine range sites in the Gunnison Area are described on the following pages. The dominant soil, climatic factors, and the potential vegetation are mentioned in the description of each site. The Guide to Mapping Units at the back of this publication shows the range site classification for most soils in the survey area. Not all are assigned to a range site.

DRY MOUNTAIN LOAM RANGE SITE

This is the most extensive range site at the lower elevations (fig. 8). Slopes are generally less than 12 percent, but range up to 30 to 40 percent. The climate is characterized by extremely cold temperatures in winter and by wide fluctuation of temperature in summer. Temperatures may be near freezing at night in summer, but in the eighties in the daytime. The average annual precipitation is 10 to 14 inches.

The soils in this site are well drained and moderately deep to shallow. The surface layer is medium textured and moderately coarse textured and in places is gravelly, channery, or stony. Permeability is moderate to rapid, and available water capacity is low.

The dominant grasses in the potential plant community are muttongrass, pine needlegrass, western wheatgrass, junegrass, squirreltail, Indian ricegrass, Sandberg bluegrass, and needle-and-thread. They form a sparse cover, like bunchgrass, beneath an open stand of big sagebrush. Scattered throughout this stand are small amounts of Indian paintbrush, sulfur buckwheat, hairy goldaster, trailing fleabane, antelope bitterbrush, Douglas rabbitbrush, and pricklypear.

Following are percentages, by weight, of the total annual yield for the potential plant community:

	Percent
Grasses:	
Muttongrass	15
Western wheatgrass	15
Pine needlegrass	10
Needle-and-thread	5
Squirreltail	5
Indian ricegrass	3
Sandberg bluegrass	3
Slimstem muhly	2
Elk sedge	2
Others	5
Forbs:	
Indian paintbrush	3
Sulfur buckwheat	2
Hairy goldaster	1
Hoods phlox	1
Others	3
Shrubs:	
Big sagebrush	15
Antelope bitterbrush	5
Douglas rabbitbrush	2
Others	3

The total annual yield of air-dry forage fluctuates between 1,200 pounds per acre in favorable years and 800 pounds per acre in less favorable years.

Continued heavy grazing results in a drastic decrease in a number of grasses. As the grasses decrease, the percentage of less palatable shrubs, such as pricklypear, phlox, and buckwheat, increases sharply. When range condition is poor, most of the original forage grasses are absent, the number of annuals increases, and plants, such as snakeweed, invade the site.

Up to 70 percent of the vegetation on this site provides forage for cattle.

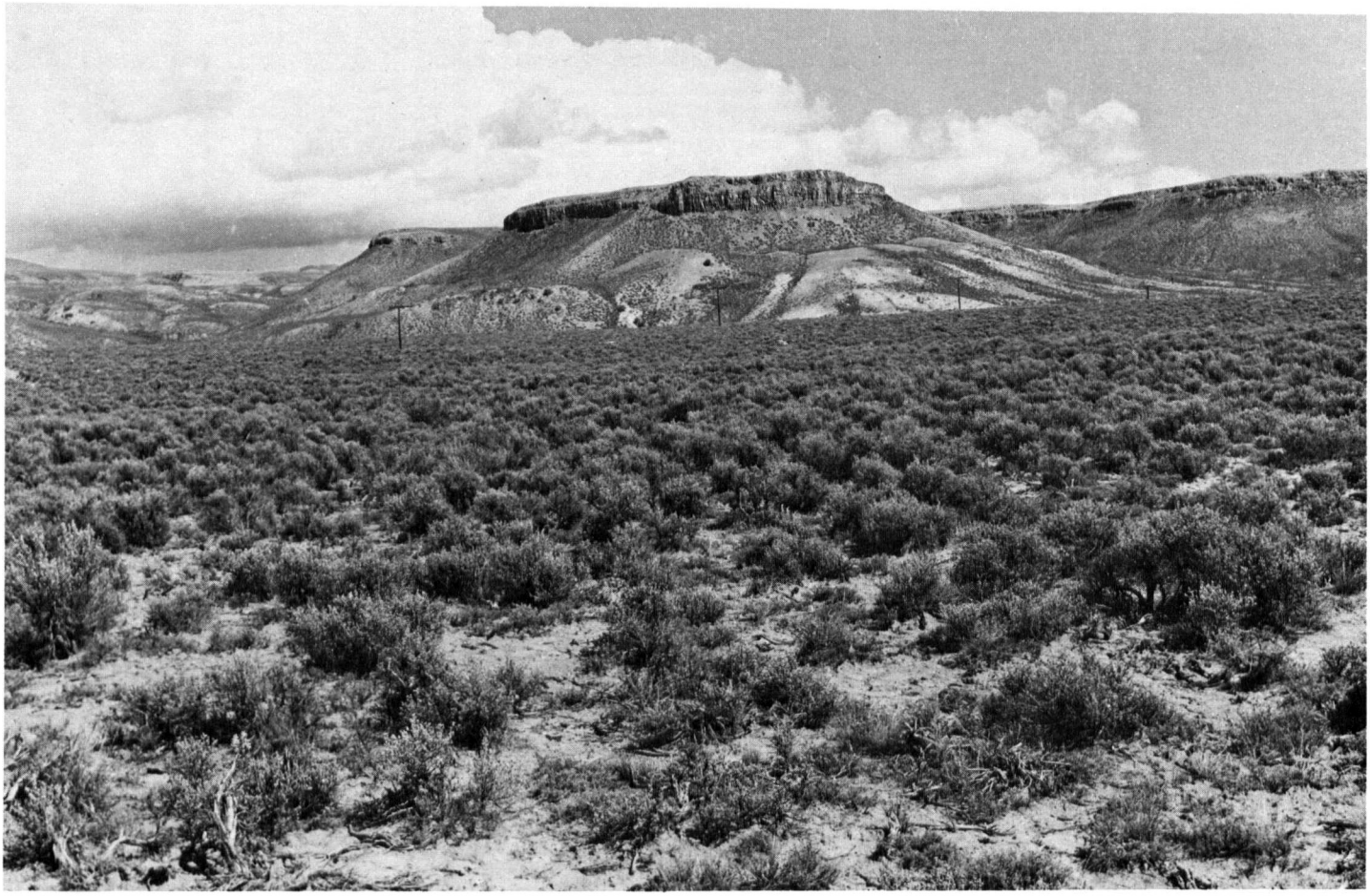

Figure 8.—**Dry Mountain Loam range site in poor condition. Unless range condition is good or excellent, big sagebrush is dominant.**

MOUNTAIN LOAM RANGE SITE

This is the most extensive range site at elevations of about 8,300 to 9,300 feet. It is also on many steep, north and northeast exposures at lower elevations (fig. 9). Slopes are mostly less than 10 percent, but in many places range up to 30 or 40 percent. The average annual precipitation is 15 to 20 inches. There is usually a good snow cover in winter.

The soils in this site are moderately deep or deep. They are medium textured and in places are gravelly, channery, or stony. Available water capacity is low to high, and permeability is slow to moderate.

An open overstory of big sagebrush and an almost unbroken cover of grasses and forbs characterize this range site. Western, slender, and bearded wheatgrass plus nodding and mountain brome, Arizona fescue, junegrass, and other grasses are dominant in the potential plant community. Forbs are western yarrow, Indian paintbrush, sulfur buckwheat, Fremont geranium, silvery lupine, and several less abundant species. Snowberry, Douglas rabbitbrush, fringed sage, and smaller amounts of serviceberry and antelope bitterbrush occur in the plant community.

Following are percentages, by weight, of the total annual yield for the potential plant community:

	Percent
Grasses:	
Arizona fescue	15
Western wheatgrass	10
Nodding brome	5
Mountain brome	5
Bearded wheatgrass	5
Slender wheatgrass	5
Junegrass	5
Mountain muhly	5
Muttongrass	5
Squirreltail	5
Elk sedge	3
Others	5
Forbs:	
American vetch	2
Indian paintbrush	2
Silvery lupine	1
Showy cinquefoil	1
Sulfur buckwheat	1
Western yarrow	1
Others	2
Shrubs:	
Big sagebrush	10
Snowberry	3
Douglas rabbitbrush	2
Others	2

Figure 9.—**Mountain Loam range site in excellent condition.**

The total annual yield of air-dry forage fluctuates between 1,800 pounds per acre in favorable years and 1,200 pounds per acre in less favorable years.

Continued heavy grazing during the growing season for several successive years results in a change in the potential plant community. Most of the main forage grasses decrease and are replaced by big sagebrush, fringed sage, western yarrow, sulfur buckwheat, Douglas rabbitbrush, and other increasers. The final stage of poor range condition is characterized by a high percentage of bare ground and annual weeds.

At least 80 percent of the vegetation on this site provides forage for cattle.

MOUNTAIN OUTWASH RANGE SITE

This site is extensive in Cochetopa Park. It is on slope wash fans, valley-fill slopes, and terraces. It also occurs as small acreages on some of the older terraces along the Lake Fork of the Gunnison River. Slopes range up to 30 percent, but are mostly less than 8 percent. The climate is characterized by extremely cold temperatures and little or no snow cover in winter. Daytime temperatures in summer are as high as the eighties, but at night near freezing temperatures are not unusual.

The soils in this site formed in outwash material. They are medium textured or moderately coarse textured and in places are gravelly, channery, or cobbly. Available water capacity is low to high, and permeability is slow to rapid.

The potential plant community consists of grasses and forbs and a few scattered shrubs (fig. 10). Arizona fescue is the dominant grass. Mountain muhly, muttongrass, and Indian ricegrass are next in abundance. Forbs are showy cinquefoil, Indian paintbrush, rose pussytoes, and Fremont geranium. Common shrubs and half shrubs are wax currant, fringed sage, winterfat, and Douglas rabbitbrush.

Following are percentages, by weight, of the total annual yield for the potential plant community:

	Percent
Grasses:	
Arizona fescue	20
Mountain muhly	10
Indian ricegrass	10
Muttongrass	10
Western wheatgrass	5
Junegrass	5
Squirreltail	5
Blue grama	2
Slimstem muhly	2
Letterman needlegrass	2

Figure 10.—**Abundance of increaser grasses on Mountain Outwash range site. Typical profile of Redcloud channery loam is in the foreground.**

	Percent
Forbs:	
Showy cinquefoil	2
Indian paintbrush	2
Fremont geranium	2
Rose pussytoes	1
Others	4
Shrubs:	
Fringed sagebrush	8
Douglas rabbitbrush	3
Big sagebrush	3
Wax currant	2
Winterfat	2

The total annual yield of air-dry forage fluctuates between 1,000 pounds per acre in favorable years and 600 pounds per acre in less favorable years.

If this site is subjected to prolonged heavy grazing or other major disturbance, a sharp reduction takes place in a number of the more palatable forage species and a corresponding increase in the species less palatable or better adapted to withstand close grazing. As the site deteriorates further, it loses most of its original plant cover and has a sparse cover of shrubs and short-growing grasses. Pingue and annual weeds invade.

About 65 percent of the vegetation on this site provides forage for cattle.

MOUNTAIN MEADOW RANGE SITE

This site occurs throughout the survey area, below timberline, in naturally irrigated and subirrigated areas in valleys and swales. Slopes are less than 5 percent. The soils are stratified and very poorly drained. They have a high organic-matter content. Numerous stones are on the surface.

The potential plant community is a lush growth of grasses, sedges, and rushes mixed with forbs and a few woody plants. Tufted hairgrass is the most abundant grass. It is closely associated with slender wheatgrass, Nebraska sedge, Baltic rush, reedgrass, foxtail barley, and other grasses. Forbs are American bistort, fireweed, showy cinquefoil, and others. Woody plants are willows, shrubby cinquefoil, and silver sagebrush.

Following are percentages, by weight, of the total annual yield for the potential plant community:

	Percent
Grasses and grasslike plants:	
Tufted hairgrass	45
Slender wheatgrass	10
Nebraska sedge	10
Baltic rush	5
Ovalhead sedge	2
Reedgrass	2
Foxtail barley	2
Others	2
Forbs:	
American bistort	5
Wild celery	2
Cow parsnip	2
Showy cinquefoil	2

	Percent
Forbs—Continued	
Rocky Mountain iris	1
Elephanthead lousewort	1
Others	5
Shrubs:	
Willow	2
Shrubby cinquefoil	2

The total annual yield of air-dry forage from this moist site varies less than that of upland sites because available moisture is generally adequate. Yields range from 4,000 pounds per acre in favorable years to 3,000 pounds per acre in less favorable years.

If this site is subjected to repeated heavy grazing, many of the palatable grasses disappear and are replaced by iris, cinquefoil, dandelion, annual weeds, and other plants.

About 90 percent of the vegetation on this site provides forage for livestock.

MOUNTAIN SWALE RANGE SITE

This site is below timberline in valleys and swales. It is in a physiographic position similar to that of the Mountain Meadow range site, but in contrast, it is not subirrigated. It is along drainageways and is subject to flooding and to deposition of new soil material. It also receives runoff from adjacent slopes during storms. Consequently, extra moisture is available for plant growth.

This site is generally associated with Dry Mountain Loam and Mountain Loam range sites. It has high potential for producing forage and can therefore determine the management of large acreages of the surrounding range. The soils are deep and have good water intake. Erosion and gullying are hazards unless the site is well managed.

The potential plant community consists of a thick cover of grasses, forbs, and shrubs. Western wheatgrass, basin wildrye, slender wheatgrass, bearded wheatgrass, nodding brome, bluegrass, and Columbia needlegrass are dominant. Silvery lupine, greenleaf bluebells, Rocky Mountain iris, and showy cinquefoil are common forbs. Mountain snowberry, serviceberry, and big sagebrush are the major shrubs.

Following are percentages, by weight, of the total annual yield for the potential plant community:

	Percent
Grasses:	
Western wheatgrass	55
Basin wildrye	10
Slender wheatgrass	3
Nodding brome	3
Bearded wheatgrass	2
Others	5
Forbs:	
Silvery lupine	5
Greenleaf bluebells	3
Rocky Mountain iris	3
Showy cinquefoil	2
Others	2
Shrubs:	
Mountain snowberry	3
Big sagebrush	2
Serviceberry	2

The total annual yields of air-dry forage fluctuates between 3,000 pounds per acre in favorable years and 2,000 pounds per acre in less favorable years.

Continued heavy grazing or other major disturbances result in an increase in big sagebrush, rabbitbrush, Kentucky bluegrass, and annual forbs. These plants replace many of the species listed in the potential plant community.

About 80 percent of the vegetation on this site provides forage for cattle.

DEEP CLAY LOAM RANGE SITE

This site is generally at higher elevations where annual precipitation is more than 15 inches. Slopes are 5 to 30 percent. The soils are moderately deep to deep. The surface layer is silty clay loam. Permeability is slow, and available water capacity is high.

Western wheatgrass, muttongrass, Arizona fescue, nodding brome, and junegrass are the principal grasses. Mulesear wyethia, arrowleaf balsamroot, silvery lupine, Fremont geranium, and American vetch are showy forbs in the potential plant community. Scattered big sagebrush, mountain snowberry, and Parry rabbitbrush are also part of the plant cover.

Following are percentages, by weight, of the total annual yield for the potential plant community:

	Percent
Grasses:	
Western wheatgrass	40
Muttongrass	10
Arizona fescue	10
Nodding brome	5
Slender wheatgrass	3
Junegrass	2
Letterman needlegrass	2
Others	5
Forbs:	
American vetch	3
Fremont geranium	2
Mulesears wyethia	2
Arrowleaf balsamroot	1
Silvery lupine	1
Others	3
Shrubs:	
Big sagebrush	5
Mountain snowberry	3
Parry rabbitbrush	3

The total annual yield of air-dry forage fluctuates between 2,500 pounds per acre in favorable years and 1,500 pounds per acre in less favorable years.

Deterioration of the potential plant community takes place under continued heavy grazing and other disturbances. The bunchgrasses are the first to decrease. Sod-forming grasses and less palatable forbs and brush increase. Serious depletion of the plant community results in a sparse stand of weeds and shrubs and accelerated erosion.

About 65 percent of the vegetation on this site provides forage for livestock.

SUBALPINE LOAM RANGE SITE

This is the most important range site in the spruce-fir climatic zone. Generally it occurs as open parks. Elevations range from 9,300 to about 11,000 feet above sea level. Annual precipitation, 60 percent of which is snow, is more than 18 inches.

The soils in this site are gently sloping to steep loams and silt loams. Some are cobbly. Some are moderately deep over bedrock. Some are deep. Permeability is

Figure 11.—**Subalpine Loam range site, on Mord soil, showing good stand of Thurber fescue.**

moderate to very slow, and available water capacity is mostly high.

A luxuriant growth of grasses and forbs and a sprinkling of shrubs characterize the potential plant community on this highly productive range site (fig. 11). Thurber fescue, the dominant grass, along with brome, bluegrass, wheatgrass, and a large number of colorful forbs, form a thick plant cover. Small amounts of silver sagebrush, mountain snowberry, and shrubby cinquefoil also grow on this site.

Following are percentages, by weight, of the total annual yield for the potential plant community:

	Percent
Grasses:	
Thurber fescue	45
Parry oatgrass	10
Nodding brome	5
Bearded wheatgrass	5
Muttongrass	5
Columbia needlegrass	3
Forbs:	
American vetch	3
Aspen peavine	3
Aspen fleabane	2
Silver lupine	2
Fremont geranium	1
Sidebells penstemon	1
Others	5
Shrubs:	
Silver sagebrush	4
Mountain snowberry	3
Shrubby cinquefoil	2
Nootka rose	1

The total annual yield of air-dry forage fluctuates between 4,000 pounds per acre in favorable years and 2,000 pounds per acre in less favorable years.

Continued heavy grazing or other harsh disturbances result in deterioration of the potential plant community. The principal forage plants decrease and are replaced by plants less palatable to grazing animals. Shorter grasses and forbs become more abundant. In the final stages of site deterioration, annual weeds invade and unstable soil conditions are apparent.

At least 70 percent of the vegetation on this site provides forage for cattle.

SHALLOW SUBALPINE RANGE SITE

This site is on mesas and benches and in open parks in spruce-fir forests. The growing conditions are similar to those on Subalpine Loam range site because this site receives more than 18 inches of moisture annually, nearly 60 percent of which comes as snow. Slopes range from 5 to 40 percent.

The soils are less than 20 inches deep over bedrock.

They are moderately coarse textured and in places are stony or gravelly. Available water capacity is low, and permeability is moderately slow.

An interrupted stand of grasses, forbs, and shrubs characterizes the potential plant community on this site. Muttongrass, Letterman needlegrass, mountain muhly, Arizona fescue, and Thurber fescue are the principal grasses. Forbs are sulfur buckwheat, showy cinquefoil, Indian paintbrush, Hoods phlox, and pussytoes. Small amounts of big sagebrush and silver sagebrush are also present.

Following are percentages, by weight, of the total annual yield for the potential plant community:

	Percent
Grasses:	
Arizona fescue	25
Mountain muhly	20
Muttongrass	15
Letterman needlegrass	5
Thurber fescue	5
Others	5
Forbs:	
Silvery lupine	2
Aspen fleabane	2
Sulfur buckwheat	1
Indian paintbrush	1
Hairy goldaster	1
Rose pussytoes	1
Others	2
Shrubs:	
Silver sagebrush	10
Fringed sagebrush	3
Wax currant	2

The total annual yield of air-dry forage fluctuates between 2,500 pounds per acre in favorable years and 1,000 pounds per acre in less favorable years.

Deterioration of the potential plant community is caused by continued heavy grazing and other disturbances. The plants most heavily grazed by livestock sharply decrease. Those that escape close grazing increase until the advanced stages of depletion, and then decrease and are replaced by invading annuals and shrubs.

Approximately 60 percent of the vegetation on this site provides forage for livestock.

ALPINE SLOPES RANGE SITE

This site is above timberline (fig. 12). Slopes range from 8 to 50 percent. The soils are deep, well drained, and medium textured. They generally are very stony, but the number of stones varies widely. Available water capacity is low, and permeability is moderate.

The potential plant community consists of plants that are well suited to a short, cold growing season and rapid drying conditions. Sedges, kobresia, alpine bluegrass, Scribner and Baker wheatgrass, alpine timothy, tufted wheatgrass, and spike trisetum make up at least half the plant cover. A variety of showy forbs including alpine clover, American bistort, showy cinquefoil, alpine bluebells, western yarrow, and rose pussytoes add to the color of the plant community. Alpine willow and shrubby cinquefoil are common in the plant cover.

Following are percentages, by weight, of the total annual yield for the potential plant community:

	Percent
Grasses and grasslike plants:	
Kobresia	20
Sedges	10
Alpine bluegrass	5
Tufted hairgrass	5
Scribner wheatgrass	3
Baker wheatgrass	2
Spike trisetum	2
Others	3
Forbs:	
Alpine clover	10
American bistort	5
Showy cinquefoil	3
Western yarrow	2
Alpine bluebells	2
Shrubs:	
Alpine willow	20
Shrubby cinquefoil	5
Others	8

The total annual yield of air-dry forage fluctuates between 1,200 pounds per acre in favorable years and 500 pounds per acre in less favorable years.

Continued heavy grazing and other disturbances cause serious depletion of this fragile alpine site. As the plant cover is thinned with a decrease of kobresia, sedges, and grasses, plants that are less heavily grazed increase slowly, and the site frequently becomes highly susceptible to erosion.

About 60 percent of the vegetation on this site provides forage for sheep.

Woodland[4]

Woodland in the Gunnison Area occurs at the edges adjacent to the U.S. National Forests, chiefly on soil associations 3, 4, and 5 (see General Soil Map). The rest of the area surveyed is largely treeless. Much of the woodland is considered to be of low commercial value; that is, the form, the shape, and the growth rate of the trees are such that management for producing wood crops is not economically feasible. The Vulcan soils in these associations are generally less productive than the other soils.

Some fairly good commercial timber grows in the western part of the survey area, on Shule and Sapinero soils. Much of this wooded tract is administered by the Bureau of Land Management. A small part is privately owned.

Logging and fires in the early days of settlement in the Gunnison Area left much of the forest unproductive. Large areas formerly in stands of conifers are now covered with aspen. In some areas aspen is being replaced by conifers. In others aspen will remain the dominant species for the next hundred years. Much of the aspen is noncommercial timber. Some, however, grows on soils and sites that have a good potential for producing wood crops. Areas in which aspen is the dominant species provide good to excellent grazing in summer.

In general the typography, climate, and soils make the areas now wooded unsuitable for cultivation. The recreation, esthetic, wildlife, and watershed values of the forest in many cases are higher than any other.

[4] W. S. SWENSON, woodland conservationist, Soil Conservation Service, helped prepare this section.

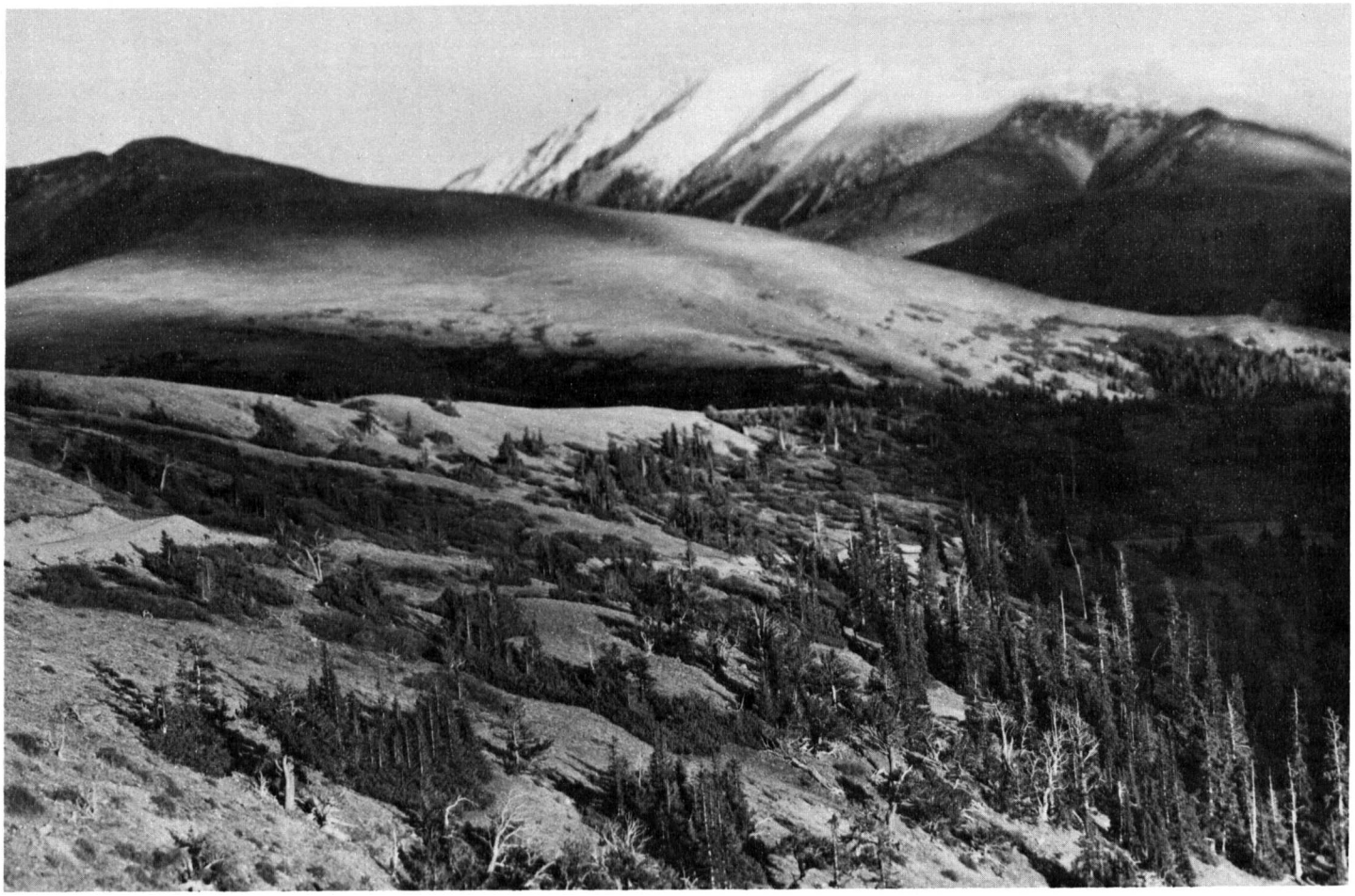

Figure 12.—Alpine Slopes range site near timberline.

The trees protect the soils against erosion and produce valuable wildlife food and cover, which is important to the economy of the Gunnison Area, and the understory provides grazing for sheep and cattle. The woodland is also important as a recreation site and valuable as watershed for the survey area. The Gunnison Area has long been noted for its hunting, fishing, and recreation. Well-kept and well-managed forests can maintain and enhance these values.

Woodland management

Management of woodland can be planned more effectively if soils are grouped according to those characteristics that affect growth of trees and management of the stands. The soils of the Gunnison Area have been assigned to four woodland groups. Each group consists of soils that are about the same in suitability for trees, potential productivity, and management requirements.

Some soils are more productive of trees than others. The height to which a species of tree will grow in a specified number of years, or the site index, indicates the productivity of a soil. The higher the site index, the higher the potential productivity of the soil.

The four woodland groups in the Gunnison Area are listed in table 3. The table shows the site index range for each group, lists the trees that are potentially good timber, shows the degree of soil-related hazards and limitations that must be considered in management, and evaluates the understory utilized as forage. The soil-related hazards and limitations are defined in the paragraphs that follow.

Plant competition refers to the rate of invasion by unwanted trees and shrubs, such as oak brush. Competition is *slight* if it does not prevent adequate natural regeneration and early growth, or interfere with the normal development of planted seedlings. Competition is *moderate* if it delays the establishment and slows the growth of seedlings, either naturally occurring or planted, but does not prevent the eventual development of a fully stocked, normal stand. Competition is *severe* if it prevents adequate restocking, either natural or artificial, without intensive preparation of the site and without special maintenance practices, including weeding.

Seedling mortality refers to the expected loss of seedlings as a result of unfavorable soil characteristics or topographic features. Even if healthy seedlings of suitable species are correctly planted or occur naturally in adequate numbers, some will not survive if conditions are unfavorable. The degrees of seedling mortality

TABLE 3.—*Woodland groups, wood crops and forage,*

Woodland groups	Tree species	Productivity		Plant competition	Seedling mortality
		Site index	Estimated time to grow sawlogs		
		Feet	*Years*		*Percent*
1	Ponderosa pine	40–50	160	Moderate	25–75
	Douglas-fir	40–50	160		
2	Douglas-fir	50–60	150	Slight	25–50
3	Engelmann spruce	55–65	180	Slight	25–50
	Lodgepole pine	45–65	180		
	Subalpine fir	50–60	180		
4	Engelmann spruce	65–90	120	Slight	0–25
	Lodgepole pine	65–76	150		
	Subalpine fir	60–80	120		

shown in table 3 are based on the mortality of seedlings among the number normally planted for adequate stocking. *Slight* indicates the loss of less than 25 percent of the seedlings; *moderate,* between 25 and 50 percent; and *severe,* more than 50 percent.

Windthrow hazard measures the effect of the soils on root development and the ability of the soil to support trees during periods of high winds. A rating of *slight* indicates that roots can penetrate to a depth of more than 20 inches and trees are not expected to be blown down in commonly occurring winds. *Moderate* indicates that roots can penetrate to a depth of 10 to 20 inches, and trees are stable except during short periods of excessive wetness and strong winds. *Severe* indicates that roots can penetrate to a depth of only 10 inches or less, and the soil and tree roots do not give enough stability to keep trees from blowing over during moderate or high winds.

Erosion hazard is rated according to the risk of erosion in well-managed woodland that is not protected by special practices. The hazard is *slight* if there is no special problem. It is *moderate* if a moderate loss of soil is expected unless runoff is controlled and if the plant cover is not adequate for protection. The hazard is *severe* if steep slope, rapid runoff, and past erosion make the soil susceptible to severe erosion and if intensive management, use of special equipment, and special methods of operation must be planned to minimize soil deterioration.

Equipment limitation refers to soil characteristics and topographic features that restrict or prohibit the use of conventional equipment for planting and harvesting wood crops, for constructing roads, for controlling unwanted vegetation, and for controlling fires. In the Gunnison Area stones, slope, mud, and snow are factors that commonly limit the use of equipment. The limitation is *slight* if there is little or no restriction on the type of equipment that can be used or the time of year that equipment can be used. The limitation is *moderate* if the use of equipment is restricted by one or more unfavorable characteristics, such as slope, stones, or other obstructions, seasonal wetness, instability, or risk of injury to roots of trees. The limitation is *severe* if special equipment is needed or the use of such equipment is severely restricted by one or more unfavorable soil characteristics.

Woodland groups

The four woodland groups in the Gunnison Area are described in the paragraphs that follow. The trees mentioned in each description occur naturally on the particular soils of the specified groups. Not all of the soils in the survey area are assigned to a woodland group. To find the woodland group to which a particular soil has been assigned, refer to the Guide to Mapping Units.

WOODLAND GROUP 1

This group consists of well-drained, strongly sloping to very steep soils that are shallow to moderately deep over bedrock. Rock outcrop is common. The surface layer is gravelly sandy loam, loam, and stony loam. Permeability is slow to moderate. Available water capacity is low. Ponderosa pine and Douglas-fir are the most common trees.

These soils provide considerable woodland grazing, particularly in open and old-age stands of ponderosa pine. Where Douglas-fir is dominant, grazing is available in interspersed open areas. Good grazing management is essential.

The site index range is 40 to 50 for ponderosa pine and Douglas-fir.

WOODLAND GROUP 2

This group consists of soils on which Douglas-fir is dominant. These deep, well-drained soils are on northern exposures in the drier parts of the survey area. The surface layer is gravelly coarse sandy loam and stony loam. Slopes are 10 to 50 percent. Permeability is moderate or slow, and available water capacity is moderate to high.

The site index range is 50 to 60 for Douglas-fir.

WOODLAND GROUP 3

This group consists of soils on which the major commercial tree species are lodgepole pine, Engelmann spruce, and subalpine fir. These soils are moderately deep to deep. They have a surface layer of loam, gravelly sandy loam, and stony loam. Slopes are 10 to 55

and factors in management

Windthrow hazard	Erosion hazard	Equipment limitation	Understory utilized as forage	Remarks
Slight	Moderate to severe	Moderate to severe	Fair to good grazing	Little or no aspen.
Slight	Moderate	Moderate to severe	Fair to poor grazing	Aspen usually poor quality.
Slight	Moderate	Moderate to severe	Fair to poor grazing except in stands of aspen.	Aspen usually not of commercial quality.
Slight	Slight	Moderate to severe	Poor grazing except in stands of aspen.	Potential for commercial quality aspen.

percent. Permeability is slow, and available water capacity is high to low. Aspen and lodgepole pine are the major trees in areas where fire or other serious disturbances have occurred.

The site index range is 55 to 65 for Engelmann spruce, 45 to 65 for lodgepole pine, and 50 to 60 for subalpine fir.

WOODLAND GROUP 4

This group consists of soils on which lodgepole pine, Engelmann spruce, and subalpine fir are dominant. These soils are in the areas of higher precipitation, on mesa tops, such as Blue Mesa. They are the most typical forest soils in the survey area. They have a higher site index and greater production potential than soils in the other woodland groups. They are moderately deep to deep. The surface layer is loam or stony loam. Slopes are 10 to 50 percent. Permeability is slow, and available water capacity is moderate or low. Most burned or distributed areas commonly revert to aspen. Some revert to lodgepole pine.

The site index range is 65 to 90 for Engelmann spruce, 65 to 76 for lodgepole pine, and 60 to 80 for subalpine fir.

Recreation[5]

Many factors determine whether or not recreational development is feasible at a given location. Some of the more important factors are the economic, legal, and social considerations and the location, climate, scenery, soil, and water.

Table 4 rates the soils in the Gunnison Area, by soil associations, according to limitations that affect their suitability for selected recreational uses. Limitations are expressed as *slight*, *moderate*, or *severe*. A *slight* limitation means that soil properties are generally favorable and limitations are so minor that they can be easily overcome. *Moderate* means that the limitation can be overcome or modified by planning, design, or special maintenance. *Severe* means that costly soil reclamation, special design, intensive maintenance, or a combination of these, is required. Some of the soil properties considered in the ratings are slope, wetness, soil texture, soil depth, hazard of flooding, and stoniness.

Onsite investigation is needed as part of the initial planning for any proposed recreational development. Specific sites within an association, for example, can have only a slight limitation for a specific use, even though table 4 shows a severe limitation for the association.

Engineering Uses of the Soils[6]

This section provides information of special interest to engineers, contractors, farmers, and others who use soil as structural material or as foundation material upon which structures are built. Some soil properties are of special interest because they affect construction and maintenance of roads and airports, pipelines, building foundations, water storage facilities, erosion control structures, drainage systems, and sewage disposal systems. Among the soil properties most important in engineering are permeability, shear strength, density, shrink-swell potential, water-holding capacity, grain-size distribution, plasticity, and reaction.

Information concerning these and related soil properties is given in tables 5 and 6. The estimates and interpretations of soil properties in these tables can be used in—

1. Planning and designing agricultural drainage systems, farm ponds, irrigation systems, terraces, and other structures used for controlling water and conserving soil.
2. Selecting potential locations for highways, airports, pipelines, and underground cables.
3. Locating portable sources of sand, gravel, or rock suitable for use as construction material.
4. Selecting potential industrial, commercial, residential, and recreational sites.

[5] ELDIE W. MUSTARD, State biologist, Soil Conservation Service, helped prepare this section.

[6] LLOYD G. LAUDENSCHLAGER, area engineer, and RONALD I. BLEWITT, assistant State conservation engineer, Soil Conservation Service, helped prepare this section.

TABLE 4.—*Limitations of soils, by soil*

Soil association	Recreation			
	Vacation ranches	Picnic and sports areas	Fishing areas	
			Natural	Developed
1. Evanston-Gas Creek-Irim	Moderate	Moderate	None to slight	None to slight
2. Parlin-Lucky-Hopkins	Moderate	Moderate	Severe	Moderate
3. Vulcan-Wetterhorn-Ruby	Severe	Moderate	Moderate	Moderate
4. Posant-Woodhall-Stony rock land	Severe	Severe	Severe	Severe
5. Shule-Youman-Passar	Moderate	Moderate	Moderate	Moderate
6. Meredith-Rockslides	Severe	Severe	Moderate	Moderate

The engineering interpretations reported here do not eliminate the need for sampling and testing, or for geological exploration, especially at the site of specific engineering works involving heavy loads or where excavations are deeper than the depths of layers here reported. Even in these situations, however, the soil map is useful in planning more detailed field investigations and for indicating the kinds of problems that may be expected.

Some terms have special meanings in soil science that may not be familiar to engineers. Such terms are defined in the Glossary.

Engineering classification systems

The two systems most commonly used in classifying soil samples for engineering are the AASHO system adopted by the American Association of State Highway Officials (*1*), and the Unified system (*7*) used by the Soil Conservation Service, the Department of Defense, and others.

In the AASHO system soils are classified in seven basic groups, according to those properties that affect their use in highway construction. The groups range from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A-1 are gravelly soils of high bearing strength. At the other extreme in group A-7 are clay soils that have low strength when wet. The best soils for road fill are therefore classified as A-1, the next best A-2, and the poorest A-7. Soil material near a classification boundary is given a symbol showing both classes, for example, A-2 or A-4. The estimated classification for all soils mapped in the survey area is shown in table 5.

The Unified system classifies soils according to those properties that affect their use as construction material or foundation material. In this system soils are grouped in 15 classes, according to particle size distribution, plasticity, and liquid limit. The eight classes of coarse-grained soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; the six classes of fine-grained soils are identified as ML, CL, OL, MH, CH, and OH; and the one class of highly organic soils is identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, CL-ML.

Estimated soil properties

Estimates of soil properties significant in engineering are shown in table 5. They are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. The seasonal high water table in most soils of the survey area is at a depth of more than 60 inches. In Alluvial land it is within a depth of 12 inches. In Gold Creek soils it is at a depth of 12 to 24 inches. In Big Blue, Gas Creek, and Irim soils it is within a depth of 36 inches. Following are explanations of some of the columns in table 5.

Depth to bedrock is the distance from the surface of the soil to the upper surface of the underlying rock.

Soil texture is described in table 5 in standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter.

Permeability is that quality that enables the soil to transmit water or air. It is estimated on the basis of soil characteristics observed in the field, particularly structure and texture. The estimates in table 5 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is an estimate of the amount of water held in the soil for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the permanent wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH values. The pH value and the terms used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is the relative change in volume to be expected of soil material when the moisture content changes, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. The amount of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils causes much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

associations, for specialized recreation

Recreation—Continued					
Camping and hiking	Hunting			Shooting preserves	Rural cottages and homesites
	Big game	Upland game	Waterfowl		
Severe	Moderate	Moderate	None to slight	Moderate	Moderate.
Moderate	None to slight	None to slight	Moderate	Moderate	Moderate.
Moderate	None to slight	Moderate	Moderate	Moderate	Severe.
Severe	Moderate	Moderate	Severe	Severe	Severe.
Moderate	None to slight	None to slight	Moderate	Moderate	Moderate.
Severe	Moderate	Moderate	Severe	Severe	Severe.

Engineering interpretations

The interpretations in table 6 are based on the estimates of engineering properties shown in table 5, on test data for soils in nearby or adjoining survey areas, and on the experience of engineers and soil scientists with the soils in the Gunnison Area. Table 6 shows the limitation or suitability of the soils for all purposes except irrigation, ponds and reservoirs, embankments, dikes, levees, and drainage of land used for crops and pasture. For these uses, table 6 lists those soil features not to be overlooked in planning, installation, and maintenance.

Limitations are expressed as *slight*, *moderate*, and *severe*. A *slight* limitation means that soil properties are generally favorable for the specified use, or limitations are minor and easily overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means that soil properties are so unfavorable and so difficult to correct or overcome that major soil reclamation, special design, or intensive maintenance is required.

Suitability of the soil is expressed as *good*, *fair*, and *poor*. These terms are approximately parallel in meaning to the terms *slight*, *moderate*, and *severe*.

Following are explanations of some of the columns in table 6.

Topsoil is used for topdressing an area where a plant cover is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as in preparing a seedbed; by natural fertility of the material, or the response of plants when fertilizer is applied; and by absence of substances toxic to plants. Texture of the soil material and content of stone fragments are characteristics that affect suitability. Also considered in the rating is damage that will result at the area from which topsoil is taken.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 6 provide guidance about where to look for probable sources of these materials. A soil rated as a *good* or *fair* source of sand or gravel generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thicknesses of overburden, location of the water table, or other factors that affect mining of the materials, nor do they indicate the quality of the deposit.

Road fill is soil material used in embankments for roads. The ratings reflect the predicted performance of a soil after it has been properly compacted and adequately drained and the relative ease of excavating the material from borrow areas.

Ponds and reservoirs hold water behind a dam or embankment. Suitable soils have low seepage, which is related to permeability and depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage and piping and that has favorable stability, shrink-swell potential, shear strength, and compaction. Stones and organic material are unfavorable.

Drainage of crops and pasture is affected by permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope and stability in ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Irrigation is affected by susceptibility to stream overflow, water erosion, or soil blowing; soil texture; content of stones; accumulations of salts and alkali; depth of the root zone; rate of water intake at the surface; permeability of soil layers below the surface layer and in hardpans or other layers that restrict movement of water; amount of water held available to plants; and the need for drainage, or depth to water table or bedrock.

Local roads and streets, as rated in table 6, have an all-weather surface and are expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. They are graded to shed water and have ordinary provisions for drainage. They are built mainly from local soil material. Most cuts and fills are less than 6 feet deep.

Soil properties that most affect the design and construction of roads and streets are load supporting capacity, stability of the subgrade, and the workability and quantity of available cut and fill material. The

TABLE 5.—*Estimates of soil*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The the instructions for referring to other series that appear in the first column of

Soil series and map symbols	Depth to bedrock	Depth from surface (typical profile)	Classification		
			USDA texture	Unified	AASHO
	Feet	*Inches*			
Alluvial land: Ad, Ao, Aw. No valid estimates can be made. Material too variable.					
Bead: BaF	>5	0–5	Fine sandy loam	SM	A–4
		5–18	Sandy clay loam	SC	A–6
		18–60	Stony clay and very stony clay	CH	A–7
Big Blue: BbA, BbB	>5	0–10	Loam	ML	A–4
		10–52	Clay and heavy clay loam	CH	A–7
		52–60	Stratified sand, gravel and cobblestones.	GW or GP	A–1
Bogan: BoE	2.0–3.0	0–16	Silt loam	ML	A–4
		16–24	Light silty clay loam	CL	A–7
		24	Interbedded shale and sandstone.		
Bosler: BsB	>5	0–22	Sandy loam	SM	A–2 or A–4
		22–32	Gravelly sandy clay loam	SC or GC	A–2
		32	Very cobbly loamy sand	SM	A–2
Carbol: CaF	1.0–1.5	0–8	Gravelly sandy loam	SM	A–2
		8–16	Gravelly sandy clay loam	SC	A–2
		16	Granite.		
Cathedral Mapped only with Kezar soils.	1.0–1.5	0–15	Very gravelly sandy loam	GP–GM	A–1
		15	Granite.		
Cebolia: CeE	>5	0–15	Loam	ML–CL	A–4
		15–60	Clay	CH	A–7
Cheadle Mapped only with Lucky soils.	1.0–1.5	0–17	Gravelly sandy loam and stony loam.	GM or SM	A–2 or A–4
		17	Fractured gneiss.		
Cochetopa: CoE	>5	0–12	Loam	ML	A–4
		12–45	Gravelly clay	CH	A–7
		45–60	Stony clay loam	CL	A–7 or A–6
Corpening: CrE	1.0–2.0	0–14	Fine sandy loam	SM	A–4
		14	Calcareous standstone.		
Curecanti: CuB	>5	0–7	Gravelly loam	SM	A–4
		7–19	Very cobbly sandy clay loam	GC	A–2
		19–60	Very cobbly sandy loam	GP–GM	A–1
Dewville: DeB, DeC	>5	0–10	Loam, gravelly sandy loam, and sandy loam.	ML or SM	A–4
		10–22	Sandy clay loam	SC	A–6
		22–60	Sandy loam	SM	A–2
Dollard: DoE	1.5–2.5	0–6	Silty clay loam	CL	A–7
		6–25	Silty clay	CH	A–7
		25	Shale.		
*Duffson: DrE, DsE For Corpening part of DrE, see Corpening series. For Spring Creek part of DsE, see Spring Creek series.	2.0–3.0	0–8	Loam	ML	A–4
		8–16	Clay loam	CL	A–6
		16–30	Loam	ML	A–4
		30	Sandstone.		
Evanston: EvB, EvD	>5	0–9	Loam	ML	A–4
		9–18	Clay loam	CL	A–6
		18–60	Loam	ML	A–4
Fola: FoB	>5	0–6	Cobbly sandy loam	SM	A–2
		6–60	Very cobbly sandy loam	SM	A–2 or A–1
Gas Creek: GaA, GaB	>5	0–7	Sandy loam	SM	A–2
		7–15	Very cobbly sandy loam	SM	A–1
		15–60	Very cobbly sand	SP–SM	A–1

properties significant in engineering

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully this table. The symbol > means more than; the symbol < means less than]

Coarse fraction greater than 3 inches	Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
	No. 4	No. 10	No. 40	No. 200				
Percent					*Inches per hour*	*Inches per inch of soil*	*pH*	
0–45	90–100	85–95	60–70	35–50	2.0–6.0	0.08–0.11	5.6–6.5	Low.
0–40	85–95	80–90	70–80	35–50	0.6–2.0	0.10–0.15	5.1–6.0	Moderate.
15–40	65–80	65–75	60–70	50–65	0.06–0.2	0.13–0.15	5.1–6.0	Moderate.
0	95–100	90–100	80–90	60–75	0.6–2.0	0.10–0.15	7.4–8.4	Low.
0	95–100	90–100	85–95	75–90	0.06–0.2	0.13–0.18	7.4–8.4	High.
0–45	20–50	10–40	5–15	0–5	>20.0	0.03–0.05	7.4–8.4	Low.
0	90–100	90–100	85–95	65–80	0.6–2.0	0.11–0.16	6.1–7.3	Low.
0	90–100	85–95	85–90	75–85	0.6–2.0	0.12–0.18	6.6–7.3	Moderate.
0	85–95	80–90	50–65	30–40	2.0–6.0	0.08–0.11	6.6–7.8	Low.
15–60	55–65	50–60	45–50	20–30	0.6–2.0	0.08–0.11	6.6–7.8	Low.
55–70	65–75	60–70	30–40	10–20	6.0–20.0	0.02–0.04	7.9–9.0	Low.
0	75–85	50–75	45–50	20–30	2.0–6.0	0.05–0.07	6.6–7.3	Low.
0	70–90	50–75	50–60	25–35	2.0–6.0	0.08–0.11	6.6–7.3	Low.
0	25–40	20–35	10–20	5–10	6.0–2.0	0.03–0.06	6.6–7.3	Low.
0–20	90–100	85–95	75–85	55–65	0.6–2.0	0.11–0.16	6.6–7.3	Low.
0–20	85–95	80–90	75–85	65–80	0.06–0.2	0.13–0.21	7.4–8.4	High.
10–45	60–75	55–70	45–65	30–50	0.6–2.0	0.05–0.07	7.0–8.5	Low.
0–20	85–95	80–90	70–85	55–65	0.6–2.0	0.10–0.15	6.6–7.3	Low.
0–20	70–90	70–90	65–85	50–75	0.06–0.2	0.13–0.21	6.6–7.3	High.
0–30	75–85	70–90	65–80	50–70	0.06–0.2	0.11–0.16	7.4–7.8	Moderate.
0–10	80–100	75–95	65–75	36–50	2.0–6.0	0.08–0.11	7.9–8.4	Low.
10–40	75–85	70–80	60–70	40–50	2.0–6.0	0.08–0.11	6.6–7.3	Low.
0–55	40–55	35–50	30–40	15–25	0.6–2.0	0.05–0.07	6.6–7.3	Low.
30–45	25–40	25–35	15–25	5–10	6.0–20.0	<0.03	6.6–7.3	Low.
0	80–100	75–95	75–85	25–65	0.6–2.0	0.10–0.15	6.6–7.3	Low.
0	80–95	75–90	65–75	35–45	0.6–2.0	0.10–0.15	6.6–7.3	Moderate.
0	80–95	75–90	50–60	25–35	2.0–6.0	0.08–0.11	7.4–8.4	Low.
0	95–100	95–100	90–95	80–90	0.06–0.2	0.12–0.18	7.4–8.4	Moderate.
0	95–100	95–100	90–95	85–90	0.06–0.2	0.13–0.21	7.9–9.0	High.
5–15	85–95	75–90	70–80	50–65	0.6–2.0	0.10–0.15	6.6–7.3	Low.
5–15	85–95	75–90	75–85	60–70	0.2–0.6	0.12–0.18	6.6–7.3	Moderate.
10–20	85–95	80–90	70–80	50–65	0.6–2.0	0.10–0.15	7.9–8.4	Low.
0–5	90–100	90–95	75–85	55–70	0.6–2.0	0.10–0.15	6.1–7.3	Low.
0–5	90–100	90–95	80–90	65–75	0.06–0.2	0.12–0.18	6.6–7.3	Moderate.
0–15	85–95	80–90	70–80	50–65	0.6–2.0	0.10–0.15	7.9–8.4	Low.
20–30	65–80	60–70	40–50	20–25	6.0–20.0	0.05–0.07	7.4–7.8	Low.
30–80	60–70	55–65	35–45	20–30	6.0–20.0	0.01–0.02	7.4–7.8	Low.
0–10	75–95	70–90	45–60	25–35	2.0–6.0	0.08–0.11	6.6–7.3	Low.
45–65	65–75	60–70	40–50	20–25	6.0–20.0	0.01–0.02	6.6–7.3	Low.
45–80	65–75	60–70	30–40	5–10	6.0–20.0	0.01–0.02	6.6–7.3	Low.

TABLE 5.—*Estimates of soil properties*

Soil series and map symbols	Depth to bedrock	Depth from surface (typical profile)	Classification		
			USDA texture	Unified	AASHO
	Feet	*Inches*			
Gateview: GeB, GeE	>5	0–10	Cobbly loam	SM	A–4
		10–60	Very gravelly sandy loam	GM or SM	A–1
Gold Creek: GrB	>5	0–9	Silty clay loam	CH	A–7
		9–41	Silty clay	CH	A–7
		41–60	Very gravelly and cobbly sand	GP	A–1
Hopkins	>5	0–16	Channery loam	ML	A–4
Mapped only with Parlin soils.		16–60	Rhyolitic flagstone	GP	A–1
Irim: IrA, IrB	>5	0–11	Loam	ML	A–4
		11–60	Very gravelly loam	GM	A–1
Jerry: JeE	>5	0–11	Loam	ML	A–4
		11–45	Gravelly heavy clay loam	CH	A–7
		45–60	Stony loam	ML	A–4
*Kezar: KcE	2.0–3.0	0–10	Gravelly sandy loam	SM	A–2
For Cathedral part of KcE, see Cathedral series.		10–26	Gravelly sandy clay loam	SC	A–2
Kubler: KuE	>5	0–15	Loam	ML or SM	A–4
		15–47	Gravelly clay	CH	A–7
		47–60	Gravelly clay loam	CL	A–7
Leaps: LeE	>5	0–10	Silty clay loam	CL or CH	A–7
		10–60	Silty clay	CH	A–7
*Lucky: LhF	1.5–3.5	0–12	Gravelly sandy loam	SM	A–2 or A–1
For Cheadle part of LhF, see Cheadle series.		12–28	Gravelly sandy clay loam	SC	A–2
		28–29	Gneiss.		
Meredith: MeF	>5	0–5	Very stony loam	ML	A–4
		5–60	Very stony silt loam	GM	A–1 or A–2
Mergel	>5	0–16	Gravelly loam	SM	A–4
Mapped only with Parlin soils.		16–60	Very gravelly loam	GM	A–1
Mord: MoE	>5	0–13	Loam	ML	A–4
		13–27	Gravelly clay loam	CL	A–6
		27–60	Gravelly clay	CH	A–7
Morop: MrE	>5	0–10	Stony loam	ML–CL	A–4
		10–25	Stony clay	CH	A–7
		25–60	Stony loam	ML	A–4
Nutras: NuF	>5	0–15	Stony loam	SM	A–4
		15–60	Extremely stony clay	CH	A–7
*Parlin: PhF, PmF	3.5–>5	0–11	Channery loam	ML	A–4
For Hopkins part of PhF, see Hopkins series. For Mergel part of PmF, see Mergel series.		11–31	Channery clay loam	CL	A–6
		31–60	Very stony loam	ML	A–4
Passar	>5	0–15	Loam and clay loam	CL	A–6
Mapped only with Youman soils.		15–60	Extremely stony clay and clay loam.	CH	A–7
Posant: PoF	1.0–2.0	0–5	Gravelly loam	SM	A–4 or A–2
		5–19	Very gravelly clay loam	GC	A–2 or A–1
		19	Quartz latite.		
Powderhorn: PwE	>5	0–24	Loam and gravelly clay loam	CL or SC	A–6 or A–2
		24–46	Gravelly clay	CH or SC	A–7 or A–2
		46–60	Gravelly clay loam	SC	A–6 or A–2
Redcloud: RcE	>5	0–60	Channery loam	SM or GM	A–4 or A–2
Rock outcrop: Ro. No valid estimates can be made. Material too variable.					
Rockslides: Rs. No valid estimates can be made. Material too variable.					

significant in engineering—Continued

Coarse fraction greater than 3 inches	Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
	No. 4	No. 10	No. 40	No. 200				
Percent					*Inches per hour*	*Inches per inch of soil*	*pH*	
15–30	75–90	70–85	55–65	40–50	0.6–2.0	0.10–0.15	6.6–7.3	Low.
15–45	35–65	30–60	20–45	10–25	6.0–20.0	0.05–0.07	6.6–7.3	Low.
0–5	90–100	85–90	80–85	70–80	0.06–0.2	0.12–0.18	8.8–10	High.
0–5	90–100	85–95	85–90	80–85	0.06–0.2	0.13–0.21	9.0–10	High.
10–45	35–45	25–35	15–20	0–5	6.0–20.0	0.01–0.02	8.5–9.6	Low.
0–15	75–85	70–80	65–75	50–60	0.6–2.0	0.10–0.15	7.4–8.4	Low.
60–100	0–10	0–5	0	0	>20.0	0–0.02	7.4–8.4	Low.
0	85–95	80–90	70–80	50–65	0.6–2.0	0.10–0.15	6.5–7.5	Low.
0–40	35–45	25–35	25–30	15–20	2.0–6.0	0.05–0.07	6.5–7.5	Low.
0–5	85–95	80–90	70–80	50–65	0.6–2.0	0.10–0.15	6.6–7.3	Low.
0–25	70–80	65–75	60–70	50–60	0.06–0.2	0.10–0.15	6.6–7.8	Moderate.
0–15	65–80	60–75	60–65	50–55	0.6–2.0	0.08–0.11	7.9–8.4	Low.
0	70–80	50–80	40–50	20–25	6.0–20.0	0.05–0.07	6.6–7.3	Low.
0	70–80	50–80	55–65	25–30	0.6–2.0	0.08–0.11	6.6–7.8	Low.
0–15	75–95	70–90	65–80	45–65	0.6–2.0	0.10–0.15	6.6–7.3	Low.
0–25	70–85	65–80	60–70	55–65	0.06–0.2	0.11–0.16	6.6–7.3	High.
5–25	70–80	65–70	60–70	50–60	0.06–0.2	0.11–0.16	7.4–8.4	Moderate.
0–10	95–100	90–100	85–95	80–90	0.06–0.2	0.12–0.18	6.1–6.5	High.
0	95–100	90–100	90–95	80–90	0.06–0.2	0.13–0.21	6.1–6.5	High.
0–10	70–90	60–80	45–50	20–30	2.0–6.0	0.08–0.11	6.6–7.3	Low.
0–25	70–85	65–75	55–65	25–35	0.6–2.0	0.10–0.15	6.6–7.3	Low.
20–50	70–80	65–75	60–65	50–55	0.6–2.0	0.01–0.02	5.1–5.5	Low.
50–80	20–50	15–45	10–40	10–35	0.6–2.0	0.01–0.02	5.6–6.0	Low.
0–10	70–80	65–75	55–65	40–50	0.6–2.0	0.10–0.15	7.9–8.4	Low.
0–45	25–50	20–50	15–40	10–25	2.0–6.0	0.05–0.07	7.9–8.4	Low.
0–15	85–95	80–90	75–85	55–65	0.6–2.0	0.10–0.15	6.1–7.3	Low.
0–25	75–85	70–80	65–75	55–60	0.06–0.2	0.12–0.18	6.1–7.3	Moderate.
15–25	65–75	60–70	55–65	50–60	<0.06	0.12–0.18	6.1–7.3	Moderate.
0–40	85–95	80–90	70–80	55–65	0.6–2.0	0.10–0.15	6.6–7.3	Moderate.
0–30	75–85	70–80	65–75	60–70	0.06–0.2	0.12–0.18	6.6–8.4	High.
0–45	70–80	65–75	60–70	50–60	0.06–0.2	0.11–0.16	7.9–8.4	Low.
15–35	70–80	65–75	60–65	40–50	0.6–2.0	0.08–0.11	5.0–6.0	Low.
40–70	65–75	60–70	60–65	50–60	0.06–0.2	0.08–0.13	5.0–7.0	Moderate.
0–30	65–75	60–70	55–60	50–55	0.6–2.0	0.08–0.11	6.6–7.3	Low.
0–25	75–80	65–75	60–70	50–60	0.2–0.6	0.11–0.16	7.4–7.8	Moderate.
55–90	75–85	70–80	65–70	50–60	2.0–6.0	0.05–0.07	7.9–8.4	Low.
0–20	85–95	80–90	75–85	60–70	0.2–0.6	0.11–0.16	6.1–6.5	Moderate.
40–75	70–80	65–75	60–70	50–60	0.06–0.2	0.08–0.11	6.1–6.5	Moderate.
0–15	55–80	50–75	40–65	25–50	0.6–2.0	0.10–0.15	6.1–7.0	Low.
0–45	25–55	20–50	30–45	10–35	0.6–2.0	0.05–0.07	6.0–7.0	Low.
0	75–90	50–80	40–70	30–60	0.2–0.6	0.11–0.16	6.0–6.8	Moderate.
0	70–85	50–75	40–65	30–60	0.06–0.2	0.12–0.18	6.0–6.8	High.
0	70–85	50–75	40–65	30–50	0.2–0.6	0.12–0.18	6.0–7.0	Moderate.
0–25	65–80	60–75	50–65	30–50	0.6–20	0.10–0.14	7.0–8.4	Low.

TABLE 5.—*Estimates of soil properties*

Soil series and map symbols	Depth to bedrock	Depth from surface (typical profile)	Classification		
			USDA texture	Unified	AASHO
	Feet	*Inches*			
Ruby: RuE, RyE	>5	0–6	Gravelly sandy loam	SM or GM	A–2 or A–1
		6–13	Gravelly clay loam	GC	A–6
		13–60	Rhyolitic flagstone	GP	A–1
Sapinero	>5	0–19	Stony and very stony loam	ML	A–4
Mapped only with Shule soils.		19–44	Extremely stony clay loam	GC or CL	A–6 or A–2
		44	Rhyolitic flagstone	GP	A–1
*Shule: SsF	1.5–3.5	0–16	Loam	ML	A–4
For Sapinero part of SsF, see Sapinero series.		16–34	Clay loam	CL	A–6
		34	Rhyolite.		
Spring Creek	1.0–2.0	0–9	Stony loam	ML	A–4
Mapped only with Duffson soils.		9–19	Gravelly and very gravelly loam	GM	A–1
		19	Rhyolitic tuff.		
Stony rock land: St. No valid estimates can be made. Material too variable.					
Sunshine: SuE	>5	0–20	Loam and gravelly loam	ML	A–4
		20–36	Extremely stony clay	CH or GC	A–7
		36	Rhyolitic flagstone	GP	A–1
Tolvar	3.5–>5.0	0–14	Gravelly coarse sandy loam	SM or GM	A–1
Mapped only with Uinta soils.		14–40	Gravelly sandy clay loam	GC	A–2
		40–60	Very gravelly coarse sandy loam	GM	A–1
Tongue River: TrF	1.5–3.5	0–13	Loam	ML	A–4
		13–20	Sandy clay loam	SC	A–6
		20–38	Silty clay loam	CL	A–6
		38	Sandstone and interbedded shale.		
*Uinta: UtF	4.0–>5.0	0–18	Stony loam	ML	A–4
For Tolvar part of UtF, see Tolvar series.		18–60	Stony and very stony clay loam	CL	A–6
Vulcan: VuE	>5	0–17	Gravelly sandy loam	SM or GM	A–1
		17–36	Very stony and gravelly clay loam and clay.	GC	A–2
		36–60	Rhyolitic flagstone	GP	A–1
Wetterhorn: WeF	1.5–3.5	0–20	Stony loam	ML or SM	A–4
		20–36	Stony clay loam	CL	A–7
		36	Quartz latite.		
Woodhall: WoF	>5	0–9	Gravelly loam	SM	A–4
		9–30	Very stony and extremely stony clay loam.	GC or SC	A–6 or A–2
		30	Fractured rhyolite.		
Woosley: WvF	1.5–3.5	0–5	Stony loam	SM	A–4
		5–30	Clay loam	CL	A–6
		30	Chlorite-schist.		
Youga: YgE	>5	0–10	Loam	ML or SM	A–4
		10–60	Gravelly clay loam	CL	A–6
*Youman: YlE, YpE	>5	0–12	Loam	ML	A–4
For Leaps part of YlE, see Leaps series. For Passar part of YpE, see Passer series.		12–60	Heavy clay loam	CH	A–7

significant in engineering—Continued

Coarse fraction greater than 3 inches	Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
	No. 4	No. 10	No. 40	No. 200				
Percent					*Inches per hour*	*Inches per inch of soil*	*pH*	
0–45	55–80	50–75	40–60	20–35	2.0–6.0	0.08–0.11	6.1–7.0	Low.
0–5	55–80	50–75	45–65	35–50	0.2–0.6	0.11–0.16	6.1–7.0	Moderate.
60–100	0–10	0–5	0	0	>20.0	0–0.02	6.5–7.0	Low.
10–30	65–85	60–80	60–65	50–55	0.6–2.0	0.10–0.14	6.6–7.3	Low.
40–70	25–65	30–60	25–55	20–50	0.2–0.6	0.08–0.11	6.1–6.5	Moderate.
60–100	0–10	0–5	0	0	>20.0	0–0.02	6.5–7.0	Low.
0–25	70–95	65–90	70–80	55–65	0.6–2.0	0.10–0.15	6.1–7.3	Low.
0–25	70–95	65–90	75–85	60–70	0.06–0.2	0.12–0.18	6.1–7.0	Moderate.
5–20	85–90	75–85	70–75	50–60	0.6–2.0	0.10–0.15	6.6–7.3	Low.
10–30	40–55	35–50	25–40	20–30	2.0–6.0	0.08–0.11	7.9–8.4	Low.
0–20	70–90	65–85	70–75	55–65	0.6–2.0	0.10–0.15	6.6–7.3	Low.
30–75	55–75	50–70	45–65	40–60	0.06–0.20	0.05–0.07	6.6–7.3	Moderate.
60–100	0–10	0–5	0	0	>20+	0–0.02	6.6–7.3	Low.
0–5	55–75	40–60	25–35	15–20	2.0–6.0	0.05–0.07	5.6–6.5	Low.
0–5	55–65	35–50	30–40	20–30	0.6–2.0	0.08–0.11	5.6–6.5	Low.
0–20	55–60	35–45	25–35	15–20	0.6–2.0	0.08–0.11	5.6–6.5	Low.
0–10	90–100	85–95	75–85	50–60	0.6–2.0	0.10–0.15	6.1–7.0	Low.
0	90–100	85–95	70–80	35–50	0.6–2.0	0.10–0.15	6.1–7.0	Moderate.
0–5	90–100	85–95	80–90	70–85	0.06–0.2	0.12–0.18	6.1–7.0	Moderate.
0–25	80–90	75–85	70–75	50–60	0.6–2.0	0.10–0.15	6.1–6.5	Low.
10–40	80–90	75–85	70–80	55–65	0.06–0.2	0.11–0.16	5.0–6.0	Moderate.
0–15	55–70	50–65	30–40	15–25	6.0–20.0	0.05–0.07	6.1–6.5	Low.
20–60	30–45	25–40	20–35	15–30	0.06–0.2	0.07–0.09	5.6–6.5	Moderate.
60–100	0–10	0–5	0	0	>20.0	0–0.02	6.1–6.5	Low.
0–20	75–85	70–80	65–70	45–55	0.6–2.0	0.10–0.15	5.6–6.6	Low.
0–25	70–85	65–75	60–65	50–55	0.06–0.2	0.12–0.18	5.6–6.6	Moderate.
0–20	70–80	65–75	50–65	35–50	0.6–2.0	0.10–0.15	6.1–7.3	Low.
50–75	45–70	40–65	35–60	30–45	0.06–0.2	0.05–0.07	6.1–7.3	Moderate.
0–30	80–90	70–80	65–75	40–50	0.6–2.0	0.08–0.11	6.6–7.3	Low.
0–25	70–95	65–90	75–85	50–70	0.06–0.2	0.12–0.18	6.6–8.4	Moderate.
0–20	75–95	70–90	60–80	40–60	0.6–2.0	0.10–0.15	6.6–7.3	Low.
0–25	75–90	70–80	65–75	55–65	0.06–0.2	0.12–0.18	6.6–7.3	Moderate.
0–15	90–100	80–90	70–80	50–65	0.6–2.0	0.10–0.15	6.1–6.5	Low.
0–25	75–100	70–95	60–90	50–70	0.06–0.2	0.13–0.18	6.1–7.3	High.

TABLE 6.—*Engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The the instructions for referring to other series

Soil series and map symbol	Suitability as source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Ponds and reservoirs	Embankments, dikes, and levees
Alluvial land: Ad, Ao, Aw	Information inadequate. Onsite determination needed.	Information inadequate. Onsite determination needed.	Information inadequate. Onsite determination. needed.	Information inadequate. Onsite determination needed.	Information inadequate. Onsite determination needed.
Bead: BaF	Poor: stony; slopes are 10 to 50 percent.	Unsuitable: excessive fines.	Poor: A–7 below a depth of 18 inches; slope is 10 to 50 percent.	Slope is 10 to 50 percent.	More than 35 percent coarse fragments, mostly stones; fair compaction characteristics.
Big Blue: BbA, BbB	Poor: poorly drained.	Unsuitable: fine-grained material.	Poor: A–7; high shrink-swell potential.	Site limited to dug ponds; seasonal high water table at the surface or within a depth of 36 inches.	Poor compaction characteristics; high shrink-swell potential.
Bogan: BoE	Fair: slope is 5 to 30 percent; bedrock at a depth of 20 to 40 inches.	Unsuitable: fine-grained material.	Poor: low shear strength; shale at a depth of 20 to 40 inches.	Slope is 5 to 30 percent; shale at a depth of 20 to 40 inches.	Poor compaction characteristics; high piping potential.
Bosler: BsB	Good	Poor: excessive fines and cobblestones.	Good: A–2; many cobblestones below a depth of 32 inches.	Rapid permeability below a depth of 32 inches.	Low compressibility; medium compacted permeability.
Carbol: CaF	Poor: bedrock at a depth of 10 to 20 inches.	Unsuitable: excessive fines.	Poor: bedrock at a depth of 10 to 20 inches.	Bedrock at a depth of 10 to 20 inches; slope is 15 to 60 percent.	Bedrock at a depth of 10 to 20 inches.
Cathedral Mapped only with Kezar soils.	Poor: bedrock at a depth of 10 to 20 inches.	Unsuitable: bedrock at a depth of 10 to 20 inches.	Poor: bedrock at a depth of 10 to 20 inches.	Bedrock at a depth of 10 to 20 inches; slope is 5 to 35 percent.	Bedrock at a depth of 10 to 20 inches.
Cebolia: CeE	Fair: clay at a depth of 15 inches.	Unsuitable: fine-grained material.	Poor: A–7; high shrink-swell potential; plastic clay below a depth of 15 inches.	Slope is 5 to 30 percent.	Clayey material; poor stability; poor compaction characteristics; high shrink-swell potential.
Cheadle Mapped only with Lucky soils.	Poor: bedrock at a depth of 10 to 20 inches.	Unsuitable: bedrock at a depth of 10 to 20 inches.	Poor: bedrock at a depth of 10 to 20 inches.	Bedrock at a depth of 10 to 20 inches; slope is 5 to 45 percent.	Bedrock at a depth of 10 to 20 inches.
Cochetopa: CoE	Fair: clay at a depth of 12 inches.	Unsuitable: fine-grained material.	Poor: A–7; plastic clay.	Slope is 5 to 30 percent.	Clayey material; poor stability; poor compaction characteristics; high shrink-swell potential.
Corpening: CrE	Poor: bedrock at a depth of 10 to 20 inches.	Poor: bedrock at a depth of 10 to 20 inches.	Poor: bedrock at a depth of 10 to 20 inches.	Bedrock at a depth of 10 to 20 inches; slopes are 5 to 40 percent.	Bedrock at a depth of 10 to 20 inches.

interpretations

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully that appear in the first column of this table]

Soil features affecting—Continued		Degree and kind of limitation for—			
Drainage of cropland	Irrigation	Local roads and streets	Dwellings without basements	Septic tank filter fields	Sewage lagoons
Information inadequate. Onsite determination needed.	Information inadequate. Onsite determination needed.	Severe: flood hazard; seasonal high water table in unit Aw.	Severe: flood hazard; seasonal high water table in unit Aw.	Severe: flood hazard; seasonal high water table in unit Aw.	Severe: flood hazard.
No drainage needed	Not applicable	Severe: slope is 10 to 50 percent; more than 35 percent stone fragments.	Severe: slope is 10 to 50 percent; moderate shrink-swell potential.	Severe: slope is 10 to 50 percent; slow permeability.	Severe: slope is 10 to 50 percent; more than 35 percent stone fragments.
Low wet areas; slow permeability.	Slow permeability; high available water capacity.	Severe: seasonal high water table at the surface or within a depth of 36 inches; high shrink-swell potential.	Severe: seasonal high water table at a depth of 0 to 36 inches; high shrink-swell potential.	Severe: slow permeability; seasonal high water table at a depth of 36 inches.	Severe: seasonal high water table at the surface or within a depth of 36 inches.
Well drained; bedrock at a depth of 20 to 40 inches; slopes are 5 to 30 percent.	Moderately deep; moderate permeability; low available water capacity.	Severe: slope is 5 to 30 percent; shale at a depth of 20 to 40 inches; low shear strength.	Severe: slope is 5 to 30 percent; bedrock at a depth of 20 to 40 inches.	Severe: slope is 5 to 30 percent; shale at a depth of 20 to 40 inches.	Severe: slope is 5 to 30 percent; shale at a depth of 20 to 40 inches.
Well drained; slope is 5 to 30 percent.	Moderate permeability; low available water capacity.	Slight	Slight	Slight: may pollute nearby domestic water supply.	Severe: rapid permeability.
No drainage needed	Not applicable	Severe: bedrock at a depth of 10 to 20 inches; slope is 15 to 60 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 15 to 60 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 15 to 60 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 15 to 60 percent.
No drainage needed	Not applicable	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 35 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 35 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 35 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 35 percent.
No drainage needed	Not applicable	Severe: slope is 5 to 30 percent; plastic clay below a depth of 15 inches; high shrink-swell potential.	Severe: slope is 5 to 30 percent; high shrink-swell potential.	Severe: slow permeability; slope is 5 to 30 percent.	Severe: slope is 5 to 30 percent.
No drainage needed	Not applicable	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 45 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 45 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 45 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope 5 to 45 percent.
Well drained; slow permeability.	Slow permeability; high available water capacity; slope is 5 to 30 percent.	Severe: slope is 5 to 30 percent; high shrink-swell potential; plastic clay.	Severe: slope is 5 to 30 percent; high shrink-swell potential.	Severe: slope is 5 to 30 percent; slow permeability.	Severe: slope is 5 to 30 percent.
No drainage needed	Not applicable	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 40 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 40 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 40 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 40 percent.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Ponds and reservoirs	Embankments, dikes, and levees
Curecanti: CuB	Poor: gravelly and cobbly.	Fair: excessive fines and cobblestones.	Good: A–1; many cobblestones.	Rapid permeability below a depth of 19 inches.	Good stability; high compacted permeability.
Dewville: DeB, DeC	Good	Poor: SM material below a depth of 22 inches.	Fair: moderate shrink-swell potential; erodible if not confined.	Slope is 1 to 15 percent; moderately rapid permeability below a depth of 22 inches.	Moderately erodible.
Dollard: DoE	Poor: high clay content.	Unsuitable: fine-grained material.	Poor: A–7; shale at a depth of 20 to 40 inches; low shear strength.	Slope is 5 to 30 percent; slow permeability.	High shrink-swell potential; poor compaction characteristics.
*Duffson: DrE, DsE For Corpening part of DrE, see Corpening series. For Spring Creek part of DsE, see Spring Creek series.	Fair: coarse fragments.	Unsuitable: fine-grained material; bedrock at a depth of 20 to 40 inches.	Fair: A–4; fair shear strength; sandstone at a depth of 20 to 40 inches.	Slope is 5 to 40 percent.	Bedrock at a depth of 20 to 40 inches; high piping potential; fair compaction characteristics.
Evanston: EvB, EvD	Fair: clay loam at a depth of 9 inches.	Unsuitable: fine-grained material.	Fair: A–4; fair shear strength.	Slope is 1 to 20 percent.	Fair stability; high piping potential; poor compaction characteristics.
Fola: FoB	Poor: high cobblestone content.	Poor: excessive fines and cobblestones.	Good: A–2 or A–1; many cobblestones.	Rapid permeability.	Low compressibility; medium compacted permeability.
Gas Creek: GaA, GaB	Poor: mostly poorly drained; high cobblestone content.	Fair: excessive fines and cobblestones; seasonal high water table less than 3 feet from surface.	Poor: A–1; seasonal high water table at less than 3 feet from surface.	Seasonal high water table at less than 3 feet from surface; rapid permeability.	Seasonal high water table at less than 3 feet from surface.
Gateview: GeB, GeE	Poor: high cobblestone content.	Poor: high cobblestone content.	Good: A–1; many cobblestones.	Rapid permeability; slope is 2 to 30 percent.	Low compressibility; medium compacted permeability.
Gold Creek: GrB	Poor: strongly to very strongly alkaline; high sodium content.	Fair for gravel; 40 inches of overburden; seasonal high water table at the surface or within a depth of 36 inches.	Poor: A–7; low shear strength; high shrink-swell potential; seasonal high water table at the surface or within a depth of 36 inches.	Seasonal high water table at the surface or within a depth of 36 inches; gravel below a depth of 41 inches.	Poor compaction characteristics; high shrink-well potential.
Hopkins Mapped only with Parlin soils.	Poor: high cobblestone content.	Unsuitable: fine-grained material; flagstone at a depth of 10 to 20 inches.	Poor: flagstone at a depth of 10 to 20 inches; slope is 5 to 45 percent.	Less than 20 inches deep to flagstone; very rapid permeability.	Flagstone at a depth of 10 to 20 inches.
Irim: IrA, IrB	Poor: poorly drained.	Poor for gravel; seasonal high water table at the surface or within a depth of 36 inches.	Poor: seasonal high water table at the surface or within a depth of 36 inches.	Moderate permeability.	Good stability; low compacted permeability.

interpretations—Continued

Soil features affecting—Continued		Degree and kind of limitation for—			
Drainage of cropland	Irrigation	Local roads and streets	Dwellings without basements	Septic tank filter fields	Sewage lagoons
Well drained; slope is 1 to 8 percent.	Moderate permeability; low available water capacity.	Slight	Slight	Slight: may pollute nearby domestic water supply.	Severe: rapid permeability below a depth of 19 inches; very cobbly.
Well drained; moderate permeability.	Moderate permeability; moderate available water capacity.	Moderate: moderate shrink-swell potential.	Moderate: slope is 1 to 15 percent; moderate shrink-swell potential.	Moderate: slope is 1 to 15 percent; moderate permeability.	Moderate: slope is 1 to 15 percent; moderate permeability.
Slow permeability; slope is 5 to 30 percent.	Slow permeability; high available water capacity; slope is 5 to 30 percent.	Severe: low shear strength; high shrink-swell potential.	Severe: slope is 5 to 30 percent; high shrink-swell potential.	Severe: shale at a depth of 20 to 40 inches; slope is 5 to 30 percent; slow permeability.	Severe: shale at a depth of 20 to 40 inches; slope is 5 to 30 percent.
No drainage needed	Not applicable	Severe: sandstone at a depth of 20 to 40 inches; slope is 5 to 40 percent; fair shear strength.	Severe: sandstone at a depth of 20 to 40 inches; slope is 5 to 40 percent.	Severe: slope is 5 to 40 percent; bedrock at a depth of 20 to 40 inches.	Severe: slope is 5 to 40 percent; bedrock at a depth of 20 to 40 inches.
Well drained; slow permeability.	Slow permeability; high available water capacity.	Fair: fair shear strength; moderate shrink-swell potential.	Moderate: slope is 1 to 20 percent; moderate stability.	Moderate: slope is 1 to 20 percent; moderate permeability.	Moderate: slope is 1 to 20 percent; moderate permeability.
Well drained; slope is 1 to 8 percent.	Rapid permeability; low available water capacity; up to 70 percent cobblestones.	Slight	Slight	Slight: may pollute nearby domestic water supplies.	Severe: rapid permeability.
Poorly drained; seasonal high water table less than 3 feet from surface.	Rapid permeability; low available water capacity; seasonal high water table at less than 3 feet from surface.	Severe: seasonal high water table at less than 3 feet from surface.	Severe: seasonal high water table less than 3 feet from surface.	Severe: seasonal high water table at less than 3 feet from surface.	Severe: seasonal high water table at less than 3 feet from surface; rapid permeability.
Well drained; rapid permeability.	Rapid permeability; low available water capacity; slope is 2 to 30 percent.	Moderate to severe: slope is 2 to 30 percent.	Moderate to severe: slope is 2 to 30 percent.	Severe: slope is 2 to 30 percent; may pollute nearby water supplies.	Severe: slope is 2 to 30 percent; rapid permeability.
Poorly drained; seasonal flooding; slow permeability.	Slow permeability; high available water capacity; strongly to very strongly alkaline.	Severe: seasonal high water table at the surface or within a depth of 36 inches; low shear strength.	Severe: high shrink-swell potential; high corrosive potential; water table at the surface or within a depth of 36 inches.	Severe: slow permeability; water table at the surface or within a depth of 36 inches.	Severe: seasonal high water table at the surface or within a depth of 36 inches.
No drainage needed	Not applicable	Severe: flagstone at a depth of 10 to 20 inches; slope is 5 to 45 percent.	Severe: open-voided flagstone at a depth of 10 to 20 inches; low shear strength.	Severe: open-voided flagstone at a depth of 10 to 20 inches.	Severe: flagstone at a depth of 10 to 20 inches; very rapid permeability.
Poorly drained; wet areas; seasonal flooding.	Moderate permeability; low available water capacity.	Severe: seasonal high water table at the surface or within a depth of 36 inches.	Severe: seasonal high water table at the surface or within a depth of 36 inches; flood hazard.	Severe: seasonal high water table at the surface or within a depth of 36 inches; flood hazard.	Severe: seasonal high water table at the surface or within a depth of 36 inches; flood hazard.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Ponds and reservoirs	Embankments, dikes, and levees
Jerry: JeE	Fair: heavy clay loam at a depth of 11 inches.	Unsuitable: fine-grained material.	Poor: A–7; plastic clay; moderate shrink-swell potential.	Slope is 5 to 30 percent.	Moderate shrink-swell potential; poor compaction characteristics.
*Kezar: KcE. For Cathedral part of KcE, see Cathedral series.	Poor: high gravel content.	Unsuitable: bedrock at a depth of 20 to 40 inches.	Poor: bedrock at a depth of 20 to 40 inches.	Permeability greater than 2.0 inches per hour; slope is 5 to 35 percent; bedrock at a depth of 20 to 40 inches.	Good stability; moderately to highly pervious.
Kubler: KuE	Fair: gravelly; clay at a depth of 10 inches.	Unsuitable: fine-grained material.	Poor: A–7; plastic clay; high shrink-swell potential.	Slope is 5 to 35 percent.	Poor compaction characteristics; high shrink-swell potential.
Leaps: LeE	Fair: 10 inches of silty clay loam over silty clay.	Unsuitable: fine-grained material.	Poor: A–7; high shrink-swell potential; plastic clay.	Slope is 5 to 30 percent.	Poor compaction characteristics; high shrink-swell potential.
*Lucky: LhF. For Cheadle part of LhF, see Cheadle series.	Poor: 15 to 20 percent gravel.	Unsuitable: bedrock at a depth of 20 to 40 inches; excessive fines.	Unsuitable: A–2; bedrock at a depth of 20 to 40 inches.	Slope is 5 to 45 percent.	Bedrock at a depth of 20 to 40 inches.
Meredith: MeF	Poor: very stony and gravelly; strongly acid.	Unsuitable: excessive stones.	Poor: excessive stones.	Slope is 8 to 50 percent; moderate permeability.	35 to 70 percent stones.
Mergel. Mapped only with Parlin soils.	Poor: gravelly	Poor for gravel; excessive fines.	Good: A–1; cobblestones may be present.	Slope is 5 to 45 percent; moderately rapid permeability.	Low compressibility; medium compacted permeability; medium piping potential.
Mord: MoE	Fair: 5 to 15 percent gravel and cobblestones.	Unsuitable: fine-grained material.	Poor: A–6 and A–7; moderate shrink-swell potential; low shear strength.	Slope is 5 to 30 percent.	Clayey material; poor compaction characteristics.
Morop: MrE	Poor: stony	Unsuitable: fine-grained material; stony.	Poor: A–4; high shrink-swell potential; low shear strength.	Slope is 5 to 40 percent.	Low compressibility; piping hazard.
Nutras: NuF	Poor: stony	Unsuitable: fine-grained material; stony.	Poor: A–7; moderate shrink-swell potential; low stability; 25 to 55 percent stones.	Slope is 5 to 40 percent.	Clayey material; low compressibility; 25 to 55 percent stones.
*Parlin: PhF, PmF. For Hopkins part of PhF, see Hopkins series. For Mergel part of PmF, see Mergel series.	Poor: 30 percent stone fragments.	Unsuitable: fine-grained material; stony.	Poor: A–4 to A–6; 40 to 80 percent stones below a depth of 31 inches.	Slope is 5 to 45 percent; very stony below a depth of 31 inches.	Medium compressibility; material limited by high stone content below a depth of 31 inches.

interpretations—Continued

Soil features affecting—Continued		Degree and kind of limitation for—			
Drainage of cropland	Irrigation	Local roads and streets	Dwellings without basements	Septic tank filter fields	Sewage lagoons
Well drained; slow permeability.	Slow permeability; moderate available water capacity; slope is 5 to 30 percent.	Severe: slope is 5 to 30 percent; low shear strength.	Moderate shrink-swell potential from a depth of 11 to 45 inches; slope is 5 to 30 percent.	Severe: Slope is 5 to 30 percent; slow permeability.	Severe: slope is 5 to 30 percent.
No drainage needed	Not applicable	Severe: bedrock at a depth of 20 to 40 inches; slope is 5 to 35 percent.	Severe: slope is 5 to 35 percent; bedrock at a depth of 20 to 40 inches.	Severe: slope is 5 to 35 percent; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; slope is 5 to 35 percent.
Well drained; slow permeability.	Slow permeability; moderate available water capacity; slope is 5 to 35 percent.	Severe: slope is 5 to 35 percent; low shear strength; high shrink-swell potential.	Severe: high shrink-swell potential; slope is 5 to 35 percent.	Severe: slow permeability; slope is 5 to 35 percent.	Severe: slope is 5 to 35 percent.
No drainage needed	Not applicable	Severe: low shear strength; slope is 5 to 30 percent; high shrink-swell potential.	Severe: slope is 5 to 30 percent; high shrink-swell potential.	Severe: slope is 5 to 30 percent; slow permeability.	Severe: slope is 5 to 30 percent.
No drainage needed	Not applicable	Severe: slope is 5 to 45 percent; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 45 inches; slope is 5 to 45 percent.	Severe: bedrock at a depth of 20 to 45 inches; slope is 5 to 45 percent.	Severe: slope is 20 to 45 percent; bedrock at a depth of 20 to 40 inches.
No drainage needed	Not applicable	Severe: slope is 8 to 50 percent; 35 to 70 percent stones.	Severe: slope is 8 to 50 percent.	Severe: slope is 8 to 50 percent; moderate permeability.	Severe: slope is 8 to 50 percent; 35 to 70 percent stones.
No drainage needed	Not applicable	Severe: slope is 5 to 45 percent.	Severe: slope is 5 to 45 percent.	Severe: slope is 5 to 45 percent.	Severe: slope is 5 to 45 percent; moderately rapid permeability.
Well drained; slow permeability.	Slow permeability; high available water capacity; slope is 5 to 30 percent.	Severe: slope is 5 to 30 percent; moderate shrink-swell potential.	Severe: slope is 5 to 30 percent; moderate shrink-swell potential.	Severe: slope is 5 to 30 percent; slow permeability.	Severe: slope is 5 to 30 percent.
Well drained; slow permeability.	Slow permeability; high available water capacity; slope is 5 to 40 percent.	Severe: high shrink-swell potential; slope is 5 to 40 percent; low shear strength.	Severe: slope is 5 to 40 percent; high shrink-swell potential.	Severe: slope is 5 to 40 percent; slow permeability.	Severe: slope is 5 to 40 percent.
No drainage needed	Not applicable	Severe: 25 to 55 percent stones; slope is 5 to 40 percent.	Severe: slope is 5 to 50 percent; moderate shrink-swell potential.	Severe: slope is 5 to 50 percent; slow permeability.	Severe: slope is 5 to 50 percent; 25 to 55 percent stones.
No drainage needed	Not applicable	Severe: slope is 5 to 45 percent; 40 to 80 percent stones below a depth of 31 inches.	Severe: slope is 5 to 45 percent.	Severe: slope is 5 to 45 percent.	Severe: slope is 5 to 45 percent; moderately rapid permeability.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Ponds and reservoirs	Embankments, dikes, and levees
Passar Mapped only with Youman soils.	Poor: clay loam to a depth of 15 inches; extremely stony clay below.	Unsuitable: fine-grained material.	Poor: A–7; low shear strength; moderate shrink-swell potential.	Slope is 5 to 30 percent; 25 to 60 percent stones below a depth of 15 inches.	Clayey material; 25 to 60 percent stones below a depth of 15 inches.
Posant: PoF	Poor: very gravelly.	Unsuitable: bedrock at a depth of 10 to 20 inches; excessive fines.	Poor: bedrock at a depth of 10 to 20 inches.	Bedrock at a depth of 10 to 20 inches; slopes are 10 to 60 percent.	Bedrock at a depth of 10 to 20 inches.
Powderhorn: PwE	Fair: gravelly loam at a depth of 12 inches.	Unsuitable: fine-grained material.	Poor: A–7; high shrink-swell potential; low shear strength.	Slope is 5 to 30 percent.	Clayey material; poor stability and compaction characteristics; high shrink-swell potential.
Redcloud: RcE	Poor: high content of stone fragments.	Unsuitable: fine-grained material.	Fair: A–4; excessive fines.	Slope is 5 to 30 percent.	Low compressibility; fair stability; medium piping potential.
Rock outcrop: Ro	Not applicable	Unsuitable: bedrock at surface.	Not applicable	Not applicable	Not applicable
Rockslides: Rs	Poor: high stone and boulder content.	Unsuitable	Not applicable	Not applicable	Not applicable
Ruby: RuE, RyE	Poor: gravelly	Unsuitable: flagstone at a depth of 10 to 20 inches.	Poor: flagstone at a depth of 10 to 20 inches; slope is 5 to 40 percent.	Flagstone at a depth of 10 to 20 inches; very rapid permeability.	Flagstone at a depth of 10 to 20 inches.
Sapinero Mapped only with Shule soils.	Poor: stony	Unsuitable: fine-grained material; stony.	Poor: stony material; fair stability; moderate shrink-swell potential; slope is 10 to 50 percent.	Slope is 10 to 50 percent; 25 to 55 percent stones.	Fair stability; dominantly stony.
*Shule: SsF For Sapinero part of SsF, see Sapinero series.	Good to a depth of 16 inches.	Unsuitable: fine-grained material.	Fair: bedrock at a depth of 20 to 40 inches; moderate shrink-swell potential; fair stability; slope is 10 to 50 percent.	Slope is 10 to 50 percent; bedrock at a depth of 20 to 40 inches.	Fair stability; bedrock at a depth of 20 to 40 inches.
Spring Creek Mapped only with Duffson soils.	Poor: stony; bedrock at a depth of 10 to 20 inches.	Unsuitable: fine-grained material; bedrock at a depth of 10 to 20 inches.	Poor: bedrock at a depth of 10 to 20 inches.	Bedrock at a depth of 10 to 20 inches; slope is 5 to 40 percent.	Bedrock at a depth of 10 to 20 inches; fair stability.
Stony rock land: St	Poor: stony	Unsuitable: stony; bedrock at less than 20 inches.	Not applicable	Not applicable	Not applicable
Sunshine: SuE	Poor: 10 to 20 percent stones.	Unsuitable: fine-grained material; flagstone at a depth of 20 to 40 inches.	Poor: moderate shrink-swell potential below a depth of 20 inches; flagstone at a depth of 20 to 40 inches.	Slope is 5 to 35 percent.	Extremely stony clayey material at a depth of 20 to 36 inches over flagstone.

interpretations—Continued

Soil features affecting—Continued		Degree and kind of limitation for—			
Drainage of cropland	Irrigation	Local roads and streets	Dwellings without basements	Septic tank filter fields	Sewage lagoons
No drainage needed	Not applicable	Severe: slope is 5 to 30 percent; 25 to 60 percent stones below a depth of 15 inches; moderate shrink-swell potential.	Severe: slope is 5 to 30 percent; moderate shrink-swell potential.	Severe: slope is 5 to 30 percent; slow permeability.	Severe: slope is 5 to 30 percent; 25 to 60 percent stones below a depth of 15 inches.
No drainage needed	Not applicable	Severe: bedrock at a depth of 10 to 20 inches; slope is 10 to 60 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 10 to 60 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 10 to 60 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 10 to 60 percent.
No drainage needed	Not applicable	Severe: high shrink-swell potential; slope is 5 to 30 percent; low shear strength.	Severe: slope is 5 to 30 percent; high shrink-swell potential.	Severe: slope is 5 to 30 percent; slow permeability.	Severe: slope is 5 to 30 percent.
Well drained; moderate permeability.	Moderate permeability; moderate available water capacity; slope is 5 to 30 percent.	Moderate to severe: GM with fines; slope is 5 to 30 percent.	Moderate to severe: slope is 5 to 30 percent.	Severe: slope is 5 to 30 percent; moderate permeability.	Severe: slope is 5 to 30 percent; moderate permeability.
Not applicable	Not applicable	Severe: bedrock at surface.	Not applicable	Not applicable	Not applicable.
Not applicable	Not applicable	Severe: slide area	Not applicable	Not applicable	Not applicable.
No drainage needed	Not applicable	Severe: flagstone at a depth of 10 to 20 inches; slope is 5 to 40 percent.	Severe: open-voided flagstone at a depth of 10 to 20 inches; slope is 5 to 40 percent.	Severe: open-voided flagstone at a depth of 10 to 20 inches; slope is 5 to 40 percent.	Severe: open-voided flagstone at a depth of 10 to 20 inches; slope is 5 to 40 percent.
No drainage needed	Not applicable	Severe: slope is 10 to 50 percent; 25 to 55 percent stones.	Severe: slope is 10 to 50 percent; moderate shrink-swell potential.	Severe: slope is 10 to 50 percent; moderately slow permeability.	Severe: slope is 10 to 50 percent; very stony.
No drainage needed	Not applicable	Severe: bedrock at a depth of 20 to 40 inches; slope is 10 to 50 percent.	Severe: bedrock at a depth of 20 to 40 inches; slope is 10 to 50 percent.	Severe: bedrock at a depth of 20 to 40 inches; slope is 10 to 50 percent.	Severe: bedrock at a depth of 20 to 40 inches; slope is 10 to 50 percent.
No drainage needed	Not applicable	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 40 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 40 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 40 percent.	Severe: bedrock at a depth of 10 to 20 inches; slope is 5 to 40 percent.
Not applicable	Not applicable	Severe: slope is 10 to 80 percent; shallow to bedrock in complex development.	Not applicable	Not applicable	Not applicable.
No drainage needed	Not applicable	Severe: stony clay; flagstone at a depth of 20 to 40 inches; slope is 5 to 35 percent.	Severe: open-voided flagstone at a depth of 20 to 40 inches; moderate shrink-swell potential; slope is 5 to 35 percent.	Severe: open-voided flagstone at a depth of 20 to 40 inches; slow permeability; slope is 5 to 35 percent.	Severe: open-voided flagstone at a depth of 20 to 40 inches; slope is 5 to 35 percent.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Ponds and reservoirs	Embankments, dikes, and levees
Tolvar Mapped only with Uinta soils.	Poor: 15 to 50 percent gravel.	Poor: GM material below a depth of 40 inches; slope is 10 to 50 percent.	Poor: A–2 over A–1 material; slope is 10 to 50 percent.	Slope is 10 to 50 percent.	Good to moderate stability.
Tongue River: TrF	Fair: sandy clay loam at a depth of 13 inches.	Unsuitable: fine-grained material; sandstone at a depth of 20 to 40 inches.	Poor: moderate shrink-swell potential; sandstone at a depth of 20 to 40 inches; slope is 10 to 50 percent.	Slope is 10 to 50 percent.	Fair stability; bedrock at a depth of 20 to 40 inches.
*Uinta: UtF For Tolvar part of UtF, see Tolvar series.	Poor: stony	Unsuitable: fine-grained material.	Poor: A–4 and A–6; slope is 10 to 50 percent; moderate shrink-swell potential; low shear strength.	Slope is 10 to 50 percent.	Stony and very stony clayey material below a depth of 18 inches; fair stability.
Vulcan: VuE	Poor: gravelly and stony.	Unsuitable: excessive fines; flagstone at a depth of 20 to 40 inches.	Poor: A–2; open-voided flagstone at a depth of 20 to 40 inches; slope is 10 to 50 percent.	Slope is 10 to 55 percent.	Open-voided flagstone at a depth of 20 to 40 inches; very stony clay loam and clay at a depth of 17 inches.
Wetterhorn: WeF	Poor: stony	Unsuitable: fine-grained material; bedrock at a depth of 20 to 40 inches.	Poor: moderate shrink-swell potential; bedrock at a depth of 20 to 40 inches.	Slope is 10 to 55 percent.	Fair stability; moderate shrink-swell potential; bedrock at a depth of 20 to 40 inches.
Woodhall: WoF	Poor: gravelly	Unsuitable: fine-grained material; bedrock at a depth of 20 to 40 inches.	Poor: A–6; 35 to 60 percent stones; moderate shrink-swell potential; bedrock at a depth of 20 to 40 inches; slope is 5 to 50 percent.	Slope is 5 to 50 percent.	Moderate shrink-swell potential; bedrock at a depth of 20 to 40 inches.
Woosley: WvF	Poor: stony	Unsuitable: fine-grained material; bedrock at a depth of 20 to 40 inches.	Poor: moderate shrink-swell potential; bedrock at a depth of 20 to 40 inches; slope is 10 to 60 percent.	Slope is 10 to 60 percent.	Clayey; moderate shrink-swell potential; bedrock at a depth of 20 to 40 inches; poor compaction characteristics.
Youga: YgE	Poor: gravelly	Unsuitable: fine-grained material.	Moderate to severe: A–6; moderate shrink-swell potential; low shear strength.	Slope is 3 to 30 percent.	Clayey; moderate shrink-swell potential; poor compaction characteristics.
*Youman: YlE, YpE For Leaps part of YlE, see Leaps series. For Passar part of YpE, see Passar series.	Fair: clay loam at a depth of 12 inches.	Unsuitable: fine-grained material.	Poor: A–7; high shrink-swell potential; low shear strength.	Slope is 5 to 35 percent.	Clayey material; high shrink-swell potential; poor compaction characteristics.

interpretations—Continued

Soil features affecting—Continued		Degree and kind of limitation for—			
Drainage of cropland	Irrigation	Local roads and streets	Dwellings without basements	Septic tank filter fields	Sewage lagoons
No drainage needed	Not applicable	Severe: slope is 10 to 50 percent.	Severe: slope is 10 to 50 percent.	Severe: slope is 10 to 50 percent; moderate permeability.	Severe: slope is 10 to 50 percent; moderate permeability.
No drainage needed	Not applicable	Severe: bedrock at a depth of 20 to 40 inches; slope is 10 to 50 percent.	Severe: bedrock at a depth of 20 to 40 inches; slope is 10 to 50 percent.	Severe: bedrock at a depth of 20 to 40 inches; slope is 10 to 50 percent.	Severe: bedrock at a depth of 20 to 40 inches; slope is 10 to 50 percent.
No drainage needed	Not applicable	Severe: slope is 10 to 50 percent; low shear strength.	Severe: slope is 10 to 50 percent; moderate shrink-swell potential.	Severe: slope is 10 to 50 percent; slow permeability.	Severe: slope is 10 to 50 percent.
No drainage needed	Not applicable	Severe: open-voided flagstone at a depth of 20 to 40 inches; slope is 10 to 55 percent.	Severe: slope is 10 to 55 percent; open-voided flagstone at a depth of 20 to 40 inches.	Severe: slope is 10 to 55 percent; open-voided flagstone ot a depth of 20 to 40 inches.	Severe: slope is 10 to 55 percent; open-voided flagstone at a depth of 20 to 40 inches.
No drainage needed	Not applicable	Severe: slope is 10 to 55 percent; bedrock at a depth of 20 to 40 inches.	Severe: slope is 10 to 55 percent; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; slope is 10 to 55 percent; slow permeability.	Severe: bedrock at a depth of 20 to 40 inches; slope is 10 to 55 percent.
No drainage needed	Not applicable	Severe: slope is 5 to 50 percent; 35 to 60 percent stones; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; slope is 5 to 50 percent.	Severe: bedrock at a depth of 20 to 40 inches; slope is 5 to 50 percent; moderately slow permeability.	Severe: bedrock at a depth of 20 to 40 inches; slope is 5 to 50 percent.
No drainage needed	Not applicable	Severe: slope is 10 to 60 percent; bedrock at a depth of 20 to 40 inches.	Severe: slope is 10 to 60 percent; bedrock at a depth of 20 to 40 inches.	Severe: slope is 10 to 60 percent; bedrock at a depth of 20 to 40 inches; moderately slow permeability.	Severe: slope is 10 to 60 percent; bedrock at a depth of 20 to 40 inches.
No drainage needed	Not applicable	Moderate to severe: slope is 3 to 30 percent; moderate shrink-swell potential.	Moderate to severe: slope is 3 to 30 percent; moderate shrink-swell potential.	Severe: slope is 3 to 30 percent; slow permeability.	Severe: slope is 3 to 30 percent.
No drainage needed	Not applicable	Severe: high shrink-swell potential; low shear strength.	Severe: slope is 5 to 35 percent; high shrink-swell potential.	Severe: slope is 5 to 35 percent; slow permeability.	Severe: slope is 5 to 35 percent.

AASHO and Unified classifications of the soil material and the shrink-swell potential indicate traffic supporting capacity. Wetness and flooding affect the stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect the ease of excavation and the amount of cut and fill needed for an even grade.

Dwellings, as rated in table 6, are no more than two stories high and are supported by foundation footings in undisturbed soil. Features that affect the suitability of a soil for dwellings are those that relate to the capacity of a soil to support a load and resist settlement and to the ease of excavation. Properties to be considered are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Septic tank filter fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material from a depth of 18 inches to 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to seasonal high water table or bedrock, and susceptibility to flooding. Slope affects layout and construction and increases the hazard of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor. The sides or embankments are compacted soil material. It is assumed that the embankment is compacted to medium density and the pond is protected from flooding. Properties to be considered are those that affect the pond floor and the embankment. Those that affect the pond floor are permeability, organic-matter content, and slope. If leveling is needed, the depth to bedrock must be considered. Properties that affect the embankment are permeability, piping potential, shrink-swell potential, and the number of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Formation and Classification of the Soils[7]

This section describes the five major factors of soil formation and explains how these factors have affected the soils of the Gunnison Area. It also defines the current system for classifying soils and classifies the soils of the Gunnison Area according to that system.

Factors of Soil Formation

Soil is a naturally occurring body at the surface of the earth that has characteristics resulting from action of the forces of the environment upon parent materials over a period of time. The character of the soil in any landscape differs from place to place, depending upon the nature and intensity of the factors that control its development.

Five major factors are recognized as being influential in the development of the soil in its virgin state at any specific location. Briefly stated, these five are climate, living organisms, time, relief, and parent material. All of these factors are highly complex. There are many kinds of climate and many combinations of biological forces. Parent materials vary widely in physical, chemical, and mineral properties, and there are great differences in the length of time that they have been subjected to the effects of climate and biological activity.

Although these five factors have been traditionally accepted as those that influence soil development, a sixth factor—man and his activities—must be added to complete the list. Man's activity is frequently but not always destructive. He drastically alters the character of the soil by such physical processes as cultivating, fertilizing, and removing parts of the soil, or he alters the natural environment by controlling water movement or plant cover.

The history of the development of soil characteristics and the study of the interaction of the formative forces is called soil genesis. The characteristics themselves constitute the soil's morphology. Thus, the color of the soil is one feature of soil morphology. The reason that such a color developed is part of the soil's genesis.

It is impossible to precisely reconstruct the history of a soil's development from the limited data available at any one location. To do so it would be necessary to observe the soil in its environment throughout the entire period of its development, which for most soils is at least several thousand years. Since this is impossible, reconstruction of a soil's genesis must be based on interpretations. These are drawn from the soil's morphology and our accumulated knowledge of how such morphology could most logically have developed.

The system of soil classification used in the United States is based on properties of the soil that can be observed or measured. The soil properties are used to group similar soils or separate those that are dissimilar. Selection of the kinds and magnitudes of properties that are to be considered as definitive between soils is guided by our understanding of soil genesis. Thus, the two are closely interrelated and both are essential to a good classification system.

In the following sections a general evaluation of the factors that influence soil development in the Gunnison Area is attempted, and the manner in which soil morphology has been used to group the soils into units of classification is outlined.

Climate

The climate in the Gunnison Area is of the continental type. Temperatures and precipitation vary widely and covariantly with elevation. Variations in elevation are extreme and occur within fairly short distances. Elevations range from about 7,200 feet in the valleys to more than 12,000 feet on some mountain peaks. Temperatures within the survey area are increasingly colder as elevation increases and increas-

[7] By ARVAD J. CLINE, senior soil correlator, Soil Conservation Service.

ingly warmer as elevation decreases. Yearly precipitation is greatest at the higher elevations. The rapidly changing character of soil climate makes generalizations relative to the entire survey area meaningless. By understanding the relationship of temperature and precipitation to elevation, a general evaluation of the climate at any given point can be made.

Average annual air temperature at the Gunnison Weather Station, elevation 7,694 feet, is 37° F., and the average air temperature in summer is about 59°. Precise weather data for the higher elevations in the Gunnison Area are not available. By projecting data from other Colorado stations at high elevations, it can be anticipated that at 11,600 feet the average annual air temperature would be approximately 27°, and the average air temperature in summer about 45°.

In evaluating soil climate, soil temperature measurements are more useful than air temperature measurements. Thirteen sites in the survey area and adjacent areas were measured to determine soil temperature at a depth of 20 inches. The site at the lowest elevation, 6,000 feet, had an average annual soil temperature of 51°, and an average soil temperature in summer of 67°. The site at the highest elevation, 11,000 feet, had an average annual soil temperature of 37° and an average soil temperature in summer of 39°. This represents a decrease of about 28° in the average annual soil temperature and 56° in the average soil temperature in summer for each 1,000 feet rise in elevation.

For those interested in soil classification, the 47° isotherm for the average annual soil temperature is at about 7,300 feet on north-facing slopes and at about 7,500 feet on south-facing slopes. The 59° isotherm for the average soil temperature in summer is at about 7,800 feet on south-facing slopes and at about 7,500 feet on north-facing slopes. The small difference in total elevation between the 47° isotherm, which marks the warmest extension of the Borolls, and the 59° isotherm, which marks their coldest extension, often occurs over so short a distance that it is impractical in many landscapes to attempt the separation of the Boroll groups. On other landscapes, such as the gently sloping tops of old pediments, changes in elevation are more gradual, and it is practical to separate these soils.

Soil temperature has a pronounced control over the activity of biological, chemical, and physical forces in soil development. When the soil is near or below 32°, soil reactions are drastically slowed, and mechanical movement caused by freezing and thawing is at a maximum. At an elevation of 6,000 feet, the soil temperature at a depth of 20 inches is 32° or below for about 90 days each year. At 7,800 feet this period is about 120 days, and at 10,000 feet it is about 180 days. Daily freezing and thawing continue in the surface horizon for longer periods at each elevation and daily variations are much greater.

Biological life, though still active, is drastically slowed when the soil temperature is 41° or lower. At 6,000 feet the soil temperature at a depth of 20 inches is above 41° for 201 days each year. At 7,800 feet, it is about 171 days, and at 10,000 feet, about 81 days.

Annual precipitation at the Gunnison station, elevation 7,694 feet, is about 10 inches. Peak periods of precipitation occur in June and August. Precipitation increases with increasing elevation, but precise data are not available in the survey area. The generalized average annual precipitation map for Colorado indicates that precipitation is about 25 inches per year at elevations above 10,000 feet and about 16 inches at 7,500 feet. Precipitation is not so uniform nor so predictable as temperature because it is subject to irregularities in wind current, and no standard increase relative to elevation can be applied with reasonable accuracy at each location.

The effectiveness of precipitation in providing a supply of soil moisture depends on many factors other than total amount. Slopes are steep, humidity is moderately low, and rainfall intensities are relatively great over much of the lower elevations. All of these factors contribute to loss of soil moisture. On the other hand, at lower elevations the soil is frozen for shorter periods, less water runs off in winter and spring, and the period of greatest activity of soil-forming processes is longer. Higher elevations receive more total precipitation, but much of it is snow, runoff is great in spring, slopes are very steep, and the ground is cold for long periods.

In summary, the climate in the Gunnison Area, relative to soil genesis, can be characterized by its extremes and variability. Characterization at any one location is difficult and depends on many factors. Reliable trends, other than those between temperature and elevation, cannot be established for the survey area.

Living organisms

Living organisms that affect soil formation can be divided on the basis of physical size into macro and micro groups. In the macrobiological group are visible plants and animals that live in or on the soil. In the microbiological group are mainly bacteria, molds, and fungi that are visible only through a microscope. Both groups are extremely important to soil genesis in the Gunnison Area.

The vegetation in the Gunnison Area is mixed grass and timber. Grasses occupy the lower elevations and stream bottoms, and timber is increasingly denser with increasing elevation. As far as can be determined, this pattern of native vegetation has persisted throughout a major part of the genetic history of the soils, or at least for a long enough period that the properties of the soil reflect the influence of the present vegetation, except where they have been destroyed by man.

The grassland soils in the Gunnison Area formed in an environment where organic matter was returned to the soil annually and decomposed in the presence of abundant calcium ions. This type of genetic process produces soil characterized by a thick, dark-colored, neutral to mildly alkaline surface layer that is relatively high in organic-matter content. Under grasses typical of this area, more organic matter is returned to the soil by the decomposition of plant roots than from yearly surface additions derived from the part of the plant above ground. This distribution pattern produces a dark-colored horizon, relatively high in organic-matter content, that extends well into the solum instead of being confined only to the surface layer.

Most soils in the Gunnison Area have this general character.

In the steeper areas or in the driest areas at low elevations, some grassland soils have not developed a thick, dark-colored surface layer. The genetic processes in these localities are probably nearly identical to those in areas where the soils have a darker surface layer. These processes, however, are proceeding at a much slower rate, and the decomposition of organic matter is nearly equal to the yearly accumulation. These light-colored soils support grass vegetation, but the grass cover is much thinner, largely because the amount of soil moisture differs locally.

Minor soil differences resulting from different amounts of vegetation are common within a landscape. Those parts of the landscape that are gently sloping or that have received additional moisture as runoff from higher lying soils generally develop the thicker, dark-colored horizons. These horizons are thinner in the steeper areas, and in areas where runoff is rapid.

As elevation increases in the Gunnison Area, the natural vegetation changes from dominantly grass to dominantly forest. This transition does not occur abruptly. In a fairly wide transitional area, timber stands are only moderately dense, and grasses, shrubs, and bushes constitute a significant part of the ground cover. In these transitional areas soils that have properties of both grassland and forest soils occur in many landscapes. It is believed that these soils represent transitional areas where trees and grasses have been actively competing for dominance during a significant part of the soil's genetic history. Such soils generally have the thick, dark surface layer characteristic of grassland soils, but also have the light-colored A2 horizon of forest soils.

At the higher elevations timber stands are more dense, and understory grasses and shrubs are sparse. Soils developed under this kind of plant cover are characterized by a relatively thin A1 horizon underlain by a light-colored, eluvial A2 horizon. The type of organic matter and the micro-organisms responsible for its decomposition are more conducive to acid conditions. The supply of soil moisture is generally higher in these areas. All of these factors combined have produced well-defined horizons of eluviation that are underlain by continuous horizons of illuviation.

The effect of animal life on the soils in the Gunnison Area is less easily distinguished than that of plant life. It appears to be nearly uniform for most soils in the survey area. Careful examination of the soil in most areas shows some evidence of mechanical mixing by earthworms, ants, or burrowing rodents. In some localities gopher activity has been unusually great. In places the soil is so thoroughly mixed to a depth of as much as 24 inches that only fragments of the original soil profile remain.

Animal activity is widespread throughout the survey area, but some selectivity is shown for certain soils. Thus, wet soils show signs of less gopher activity than dry soils, and worms or insects tend to select soils having temperatures that are best suited to their habits.

Very little is known specifically about micro-organisms in soils of the Gunnison Area. Those micro-organisms best adapted to neutral or alkaline soils, alternate wet and dry periods, and moderately large seasonal ranges in soil temperature are dominant at lower elevations. Strains active in more acid environments, prolonged wet periods, and cool soil temperatures with fairly narrow seasonal fluctuation are more active at higher elevations.

Time

If the kind and magnitude of all other forces active in soil formation are equal, the parts of any given landscape that have been subjected to this activity for the longest period will have the strongest degree of soil development. It is difficult, however, to determine the chronological age of a soil, for obviously no such uniformity exists among the soil-forming forces. The degree of horizon development in a soil profile may have resulted from differences in the intensity of factors other than time. Consequently, the degree of development alone is not a reliable criterion.

Unless specific dating can be accomplished by archeological means or by evaluating the decay of radioactive substances, the soil scientist must rely upon geomorphic studies of landscape evolution to arrive at relative dates for particular landscapes. Unfortunately, good geomorphic studies require skilled geomorphologists. In his daily work, however, the soil scientist can arrive at some of the more general relationships within his area.

In such comparisons care is needed in interpreting the chronological age of a soil from the degree of genetic development. Genetically young soils often occur in deposits of great chronological age where, for example, natural erosion has prevented the development of a mature soil by yearly removal of soil material throughout the ages. Only the most advanced degree of development can be considered as a reasonable indication of relative age.

In the Gunnison Area the problem of dating soils is made more difficult by the nature of the terrain. The landscape is one of mountains and valleys where the forces of natural erosion are extremely active. Geologic erosion cycles are of relatively short duration. Landforms shaped by one cycle can be obliterated or badly dissected by subsequent cycles so that the untrained observer cannot readily reconstruct the landscape of any one period in time.

As a result of these difficulties the influence of time on soil development in the Gunnison Area is poorly understood. Only a few of the most obvious differences are mentioned in the paragraphs that follow.

Recent alluvial deposits on flood plains and fans are youthful deposits that in many places are still in the process of being built. They vary widely in physical, chemical, and mineralogical properties, and their character is mostly inherited from parent rocks from which they weathered.

The soils that formed in this material vary as widely in character as the parent sediments. All have very weak, if any, genetic horizonation.

Terrace levels and fans of youthful to moderate age are remnants of stream terraces or alluvial fans that

are older than the present flood plains. They occur in most of the broader valleys in the survey area and are a mixed system of pediment surfaces associated with past erosion cycles. Their age in any one landscape can vary appreciably, and no attempt has been made to distinguish between ages.

Characteristics of the soils developing in these materials vary widely, but all show some degree of genetic horizon development other than the development of an A horizon. The B2 horizon ranges from weak evidence of alteration to a continuous illuvial horizon of silicate clay accumulation. Carbonate translocation is evident in areas where the parent material originally contained free carbonates.

The lack of specific dating for these land surfaces makes it impossible to specifically relate any one landform with any degree of solum development. In localized areas, where the other forces of soil formation are approximately equal, it can be assumed that differences in degree of horizonation can be partially attributed to differences in age.

Glacial till deposits are discontinuous deposits on mountain slopes and the remnants of moraines mostly in high mountain areas. According to geologists these deposits are of Wisconsin age. They are stony and gravelly mixed deposits generally leached of free carbonates in excess of 5 feet. They are thought to be the product of local valley glaciation and consequently owe much of their physical and chemical properties to the character of bedrock in the valley in which they occur.

Soils that developed in these deposits are chiefly Typic Cryoboralfs, but the prevalence of soils having a continuous illuvial horizon of silicate clay indicates their comparative age.

Old pediment surfaces that are apparently unrelated to present erosion cycles occur throughout the survey area. They commonly occur as the flat tops of isolated mesas or broad, westward sloping divides. The parent material varies in physical, chemical, and mineral properties, but within any one landscape it generally is uniform in character and unrelated to the parent material in surrounding areas.

Soil patterns in such areas are dominated by soils having an illuvial horizon of silicate clay, but less differentiated or even genetically youthful soils may occur at focal points of geologic erosion.

Residual or locally transported material consists of material weathered in place from bedrock or transported for such short distances that little mixing has occurred. Because the terrain is mountainous, bedrock is close to the surface throughout a large part of the survey area. Soil material that was derived from bedrock ranges widely in all properties and at any one location reflects the character of the parent material.

No attempt is made to fix a chronological age to such deposits for presumably they could range in age from recent times to a period preceding the development of the mountain system. That some deposits are extremely old is suggested by the extraordinary thickness of the solum and individual horizons and, in particular, by the thickness and degree of development of some of the horizons of silicate clay accumulation. On the other hand, genetically young soils occurring on these deposits do not necessarily imply youthful parent material, since geologic erosion may have kept pace with genetic development.

Relief

Some of the effects of relief on soil development have been discussed in preceding paragraphs. The slope, shape, or contour of any part of a landscape has a pronounced effect on soil development, mainly through the physical control such factors exert on water movement, both in and over the soil. Landform and contour also affect soil temperature, wind movement, and geologic or accelerated erosion.

The effect of slope and contour on distribution of surface water is easily understood. Since the amount of water entering the soil is important to both the kind and degree of soil genesis, any factor that regulates the entry of water into the soil, or its movement in the soil, becomes equally important.

In parts of the Gunnison Area soil moisture is in short supply for at least part of each growing season. Consequently, the amount of water stored in the soil during periods of available moisture is very important. Nearly level areas where runoff is minimized, concave areas that tend to collect runoff, or areas below landscapes where runoff is high have the kind of relief that is advantageous to the storage of water and to its utilization in soil genetic processes. All such areas tend to have thicker and more strongly developed horizonation and to be more strongly leached and darker in color.

Some wearing away of sediment from all parts of a landscape is normal and is often referred to as geologic erosion. The intensity of such an erosive process increases as slope increases or as water is channeled. Consequently, some parts of a landscape have a natural rate of removal that exceeds the rate of soil development. Under these circumstances mature soils can never develop. Such areas are extensive in the Gunnison Area where elevations change rapidly over short distances.

Landform and, more importantly, direction of slope exert an influence on soil temperature. Slopes facing the sun are warmer than those sheltered from the sun's rays during much of the day. This effect is pronounced in the high mountain areas where solar energy delivered to the soil becomes important in counteracting vertical, thermal stratification or air currents.

The effect of relief in controlling wind currents is not well understood, and observations are generally applicable only to local conditions. Most noticeable in the Gunnison Area is the effect of relief on the accumulation of winter snow. In some alpine areas snow accumulation can prohibit the growth of native vegetation. In others it can provide supplies of moisture sufficiently different to control the kind of vegetation.

Parent material

A wide variety of parent material occurs in the mountainous landscape of the Gunnison Area. The chemical, physical, and mineral character of the parent material constitutes the basic properties with which the factors of soil formation must deal. Consequently, parent material is important to any understanding of

genesis since it represents the original state from which the kind and degree of change must be evaluated.

A complete evaluation of the character of parent material relative to the changes introduced by soil development can only be successfully made at each specific location. Some general observations about broad characteristics of some kinds of parent material in the Gunnison Area can be made, but it must be emphasized that the observations made are general in nature and do not adequately characterize the parent material for any specific soil at any specific location.

Recent flood plain alluvium consists of young deposits on flood plains and low terraces. These deposits vary widely from place to place in color, texture, reaction, and clay composition. More importantly, they vary widely in these properties vertically within any one soil. It is this pronounced degree of vertical variability and the irregular distribution of organic carbon from strata to strata that make them unique.

Gray and brown recent deposits on fans and foot slopes have most of the variability that characterizes the flood plain deposits, but they are relatively uniform vertically. The content of organic matter is highest in the surface horizon and decreases uniformly with increasing depth. In the Gunnison Area most of these deposits are medium textured to moderately fine textured, calcareous, and of 7.5YR or yellower hue. Sedimentary rocks of the Dakota, Mancos, and Mesa Verde beds are the principal sources of sediment. Rhyolite, andesite, granite, gneiss, schist, and basalt rocks have also contributed to these sediments in places.

Red or reddish-brown recent fans and foot slopes are similar in most respects to the preceding group. They differ in having hue of 5YR or redder. Jurassic and Triassic sedimentary rocks are the major contributors of sediment. These materials are characterized by low aggregate stability and are susceptible to erosion, particularly gullying.

Glacial till consists of discontinuous deposits, generally on mountainsides at higher elevations. These deposits are remnants of till sheets or lateral moraines formed by local valley glaciers in Wisconsin time. They are dominantly moderately fine textured to fine textured, stony or gravelly, mixed material originating from rocks that form the sides and floor of the valleys in which the glacier formed. This material generally is crystalline, igneous, or metamorphic rock.

Old Tertiary pedisediments are mixed deposits on the tops of isolated mesas or broad westward sloping divides. Textures are variable but dominantly moderately coarse to moderately fine. Soils that formed in these deposits normally contain free carbonates and distinct horizons of secondary carbonate accumulation. These soils usually contain considerable rounded gravel and cobblestones. Beds of sand and gravel occur in places at a depth of less than 40 inches.

Pleistocene fans and terraces are deposits formed by coalescing fans and terraces associated with erosion cycles older than the recent deposits of streams and foot slopes, but younger than Tertiary pedisediments. These deposits are dominantly medium textured, moderately fine textured, or fine textured. Their general character is derived from the bedrock in their vicinity. Some deposits contain free carbonates and others do not, but rarely are they more than slightly acid in reaction.

Residual or locally transported material from sedimentary bedrock occurs extensively throughout the area, but is most plentiful at lower elevations. This material typically is no redder than 7.5YR hue. It is calcareous, medium textured, moderately fine textured, or fine textured, and relatively free of coarse fragments. Rocks of the Dakota, Mancos, Mesa Verde, and Morrison Formations are the principal contributors of sediment.

Some beds of volcanic breccia occur in the Gunnison Area and have been included with the sedimentary material. The breccia differs in many respects from the sedimentary rocks previously described. It is of minor importance as it relates to soil formation.

Residuum from crystalline bedrock consists of deposits that have weathered in place or have been locally transported from exposures of crystalline bedrock. These deposits vary in character, depending on the kind of parent rock. Generally they have few free carbonates and a moderate amount of coarse fragments.

The material derived from granite tends to have a moderately high sand content and a more than normal amount of medium and coarse, angular sand. The content of fine and very fine, angular granitic gravel is high. Generally this material is noncalcareous.

Material derived from rhyolite, andesite, and tuff tends to be medium textured to moderately fine textured and mildly alkaline to calcareous, and to contain a large number of flagstone and channery fragments. The bedrock often physically weathers to a mass of overlapping flagstones that has open spaces between the stones.

Material weathered from gneiss and schist is generally moderately coarse textured, medium textured, or moderately fine textured and neutral to mildly alkaline. It contains relatively large amounts of mica. Coarse fragments are commonly subangular cobblestones and stones.

Material weathered from basalt tends to be medium textured to moderately fine textured and calcareous. It contains subangular to angular gravel, cobblestones, and stones. Silt content tends to be high in these soils, and cation exchange properties of the clay fraction are high.

Classification of the Soils

The current system of soil classification (*3*, *5*) was adopted by the Cooperative Soil Survey in 1965 and replaced the older system (*2*), which was adopted in 1938. It is a comprehensive system, designed to accommodate all soils. In this system classes of soils are defined in terms of observable or measurable properties. The properties chosen are primarily those that result in the grouping of soils of similar genesis, or mode of origin. Genesis does not, however, appear in the definitions of the classes.

The current system of classification has six categories. Beginning with the most inclusive, the categories are the order, the suborder, the great group, the subgroup, the family, and the series. Table 7 shows

TABLE 7.—*Soil series classified according to the current system of classification*

Series	Family	Subgroup	Order
Bead	Fine, montmorillonitic	Typic Cryoboralfs	Alfisols.
Big Blue	Fine, montmorillonitic, calcareous, frigid	Typic Haplaquolls	Mollisols.
Bogan	Fine-silty, mixed	Argic Cryoborolls	Mollisols.
Bosler	Fine-loamy over sandy or sandy-skeletal, mixed	Borollic Haplargids	Aridisols.
Carbol	Loamy, mixed	Argic Lithic Cryoborolls	Mollisols.
Cathedral	Loamy-skeletal, mixed	Lithic Haploborolls	Mollisols.
Cebolia	Fine, montmorillonitic	Abruptic Cryoborolls	Mollisols.
Cheadle	Loamy-skeletal, mixed	Lithic Cryoborolls	Mollisols.
Cochetopa	Fine, montmorillonitic	Argic Pachic Cryoborolls	Mollisols.
Corpening	Loamy, mixed	Lithic Haploborolls	Mollisols.
Curecanti	Loamy-skeletal, mixed	Aridic Argiborolls	Mollisols.
Dewville	Fine-loamy, mixed	Typic Cryoborolls	Mollisols.
Dollard	Fine, montmorillonitic, calcareous, frigid	Ustic Torriorthents	Entisols.
Duffson	Fine-loamy, mixed	Aridic Argiborolls	Mollisols.
Evanston	Fine-loamy, mixed	Aridic Argiborolls	Mollisols.
Fola	Loamy-skeletal, mixed	Borollic Camborthids	Aridisols.
Gas Creek	Sandy-skeletal, mixed, frigid	Typic Haplaquolls	Mollisols.
Gateview	Loamy-skeletal, mixed	Pachic Cryoborolls	Mollisols.
Gold Creek	Fine, montmorillonitic, calcareous, frigid	Vertic Haplaquolls	Mollisols.
Hopkins	Fine-loamy over fragmental, mixed	Torriorthentic Haploborolls	Mollisols.
Irim	Loamy-skeletal, mixed, noncalcareous, frigid	Typic Haplaquolls	Mollisols.
Jerry	Fine, montmorillonitic	Argic Cryoborolls	Mollisols.
Kezar	Fine-loamy, mixed	Argic Cryoborolls	Mollisols.
Kubler	Fine, montmorillonitic	Pachic Argiborolls	Mollisols.
Leaps	Fine, montmorillonitic	Typic Cryoborolls	Mollisols.
Lucky	Fine-loamy, mixed	Argic Cryoborolls	Mollisols.
Meredith	Loamy-skeletal over fragmental, mixed	Pergelic Cryumbrepts	Inceptisols.
Mergel	Loamy-skeletal, mixed	Torriorthentic Haploborolls	Mollisols.
Mord	Fine, montmorillonitic	Boralfic Cryoborolls	Mollisols.
Morop	Fine, montmorillonitic	Aridic Argiborolls	Mollisols.
Nutras	Clayey-skeletal, montmorillonitic	Typic Cryoboralfs	Alfisols.
Parlin	Clayey over loamy-skeletal, montmorillonitic	Aridic Argiborolls	Mollisols.
Passar	Clayey-skeletal, montmorillonitic	Argic Cryoborolls	Mollisols.
Posant	Clayey-skeletal, montmorillonitic	Lithic Argiborolls	Mollisols.
Powderhorn	Fine, montmorillonitic	Boralfic Cryoborolls	Mollisols.
Redcloud	Fine-loamy, mixed	Typic Cryoborolls	Mollisols.
Ruby	Fine-loamy over fragmental, mixed	Argic Cryoborolls	Mollisols.
Sapinero	Loamy-skeletal over fragmental, mixed	Typic Cryoboralfs	Alfisols.
Shule	Fine-loamy, mixed	Typic Cryoboralfs	Alfisols.
Spring Creek	Loamy-skeletal, mixed	Lithic Cryoborolls	Mollisols.
Sunshine	Clayey-skeletal, montmorillonitic	Boralfic Cryoborolls	Mollisols.
Tolvar	Loamy-skeletal, mixed	Typic Cryoboralfs	Alfisols.
Tongue River	Fine-loamy, mixed	Typic Cryoboralfs	Alfisols.
Uinta	Fine-loamy, mixed	Typic Cryoboralfs	Alfisols.
Vulcan	Clayey-skeletal, montmorillonitic	Typic Cryoboralfs	Alfisols.
Wetterhorn	Fine, montmorillonitic	Typic Cryoboralfs	Alfisols.
Woodhall	Loamy-skeletal, mixed	Argic Cryoborolls	Mollisols.
Woosley	Fine-loamy, mixed	Argic Cryoborolls	Mollisols.
Youga	Fine-loamy, mixed	Argic Cryoborolls	Mollisols.
Youman	Fine, montmorillonitic	Argic Cryoborolls	Mollisols.

the classification of the soils of the Gunnison Area according to this system.

Ten soil orders are recognized: Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate orders are those that tend to give broad climatic groupings of soils. Two exceptions of this generalization are the Entisols and the Histosols, both of which occur in many different climates.

Each order is divided into suborders, mainly on the basis of soil characteristics that result in grouping soils according to genetic similarity. The climatic range is narrower than that of the order. The properties used are mainly those that reflect either the presence or absence of waterlogging or differences in climate or vegetation.

Each suborder is divided into great groups on the basis of similarity in the kind and sequence of the major soil properties. The horizons considered are those in which clay, iron, or humus have accumulated and those in which pans that interfere with the growth of roots and the movement of water have formed. The properties are soil temperature, chemical composition (mainly content of calcium, magnesium, sodium, and potassium), and the like.

In the following paragraphs each of the five orders represented in the Gunnison Area and the suborders in the great group subdivisions are briefly described. As the system proceeds from the order to the great group, each grouping of soils is narrower in scope and has a higher prediction value for soil usage.

Entisols are the soils that are so youthful that they

do not have distinct genetic horizons. They have only slight darkening of the surface horizon or an inconsistent accumulation of soluble salts. There may be considerable physical or chemical difference among these soils, but these differences are characteristics of the parent material and are not the result of soil development. The common characteristic of Entisols is a lack of distinguishing genetic horizonation.

The only major subdivision of Entisols represented in the Gunnison Area is the Orthents. These are well-drained soils that are finer than loamy fine sand, lack fragments of diagnostic horizons in the upper part, and have an organic-matter distribution pattern that reaches a maximum in the surface horizon and decreases with increasing depth.

The only subdivision of the Orthents represented in the Gunnison Area is the Torriorthents, which are in dry areas where soil moisture supplies are limited.

Aridisols are light-colored, dry soils that have been in place long enough to have distinct genetic horizonation in harmony with the forces of their environment. Although they are primarily grassland soils, the decomposition of organic matter has more or less equalled the yearly addition to the soil. Consequently, they do not have the dark surface horizon that characterizes the Mollisols. In the Gunnison Area these soils are associated with Mollisols, but they generally occupy those parts of the landscape where runoff or soil texture has proportionately restricted the entry of moisture into the soil.

Subdivisions of the Aridisols represented in the Gunnison Area are the Orthids and Argids. Orthids have a B2 horizon that shows some evidence of alteration but not of illuviation. The only subdivision of Orthids in the Gunnison Area is the Camborthids.

Argids have a B2t horizon of illuvial silicate clay. Haplargids, the only Argids in the Gunnison Area, have an illuvial B2t horizon of silicate clay that is not saturated with sodium, has a gradual increase in clay at its upper boundary, and is not associated with a duripan or a petrocalcic horizon.

Mollisols are grassland soils of the more moist parts of the survey area. They are characterized by a thick, dark-colored, friable surface horizon in which plentiful supplies of organic matter have accumulated. This accumulation is the result of the decomposition, under neutral to alkaline conditions, of fairly large yearly additions of plant material to the surface horizon, either the fall of plant remains or the decay of root systems. The common characteristic of Mollisols is the darkened, friable, base-enriched surface horizon that soil scientists refer to as a mollic epipedon.

Two subdivisions of Mollisols, Aquolls and Borolls, are represented in the Gunnison Area. Aquolls are saturated during part of each growing season. They have properties associated with the reduction or oxidation of iron compounds. Under poor aeration, the iron compounds are segregated but not completely removed from the soil. Borolls are well drained and are associated with a cold climate. Their average annual soil temperature at a depth of 20 inches is less than 47° F.

In the Gunnison Area the Aquolls are represented by the Haplaquolls. These soils lack a horizon of silicate clay accumulation and have no duripan or strong concentration of secondary carbonate. In the Gunnison Area they have an average annual soil temperature of less than 47°. Their average soil temperature in summer is more than 58°.

Borolls are subdivided into Haploborolls, Argiborolls, and Cryoborolls. Haploborolls do not have a horizon of silicate clay accumulation and have an average soil temperature in summer of more than 59°. Argiborolls have a B2t horizon of silicate clay accumulation and an average soil temperature in summer of 59° or more. Cryoborolls have an average soil temperature in summer of less than 59°.

Inceptisols are weakly developed soils that have more horizonation than Entisols, but do not have a horizon of silicate clay accumulation. They have a dark-colored surface horizon similar to that of the Mollisols, but differ from the Mollisols in having less than 50 percent base saturation in the surface horizon.

Umbrepts, the only subdivision of Inceptisols represented in the Gunnison Area, have a dark-colored, organic-matter-rich surface horizon of low base status.

Cryumbrepts, the only subdivision of Umbrepts represented in the survey area, have characteristics of the Umbrepts, but occur in cold areas where the average annual soil temperature is less than 47° and the average soil temperature in summer is less than 59°.

Alfisols are light-colored soils in the colder parts of the survey area that have genetic horizons of silicate clay accumulation and are more than 60 percent base saturated. In the Gunnison Area they are represented by the timbered soils at high elevations. Boralfs are the only Alfisols represented in the Gunnison Area. They have an average annual soil temperature of less than 47°. Cryoboralfs, the only subdivision of Boralfs represented in the Gunnison Area, have all the properties of the Boralfs. In addition, if they do not have an O horizon, they have an average soil temperature in summer less than 59°. If they have a thick O horizon and occur under dense stands of timber, the average soil temperature in summer is 48°.

Each great group is divided into subgroups, one that represents the central (typic) concept of the group, and others, called intergrades, that have one or more properties of another great group, suborder, or order.

Families are established within each subgroup, primarily on the basis of properties important to the growth of plants or properties significant in engineering. Texture, clay composition, reaction, soil temperature, permeability, thickness of horizons, and consistence are among the properties considered.

A series is a group of soils that have horizons similar in all important characteristics, except for texture of the surface layer, and similar in arrangement in the profile. (See the section How This Survey Was Made.)

Briefly described in the following paragraphs are the major characteristics of each of the subgroups and their subdivision into families. Information about individual series is in the section Descriptions of the Soils.

Ustic Torriorthents occur in the dryer parts of the Gunnison Area. When the soil temperature at a depth of 20 inches is above 41° F., they are moist in some part

of the moisture control section for more than one-fourth, but less than one-half, of the time. In the Gunnison Area they are light-colored, calcareous soils that have no genetic horizonation other than a slight darkening of the surface horizon, weak grades of structure, or inconsistent accumulation of soluble salts at any depth. They are mildly alkaline to strongly alkaline, fine textured, and calcareous throughout. The average annual soil temperature at a depth of 20 inches is less than 47°. The average soil temperature in summer is 59° or more.

Borollic Camborthids are light-colored, moderately coarse textured, mildly alkaline soils that have a B2 horizon showing evidence of alteration but having no silicate clay accumulation. In the Gunnison Area these soils are noncalcareous throughout. The lack of carbonate is not the result of genesis but is characteristic of the parent sediment. These soils are associated with large amounts of gravel and cobblestones and are more than 35 percent coarse fragments throughout the solum and C horizon. The average annual soil temperature at a depth of 20 inches is less than 47°. The average soil temperature in summer is 59° or more.

Borollic Haplargids are light-colored, moderately well developed, well-drained soils in areas where the average annual soil temperature is less than 47° and the average soil temperature in summer is 59° or more. They are characterized by a light-colored A horizon, a continuous, illuvial B2t horizon of silicate clay accumulation, and continuous horizons of secondary carbonates. The content of organic carbon in the surface horizon decreases uniformly with increasing depth. In the Gunnison Area these soils are underlain by beds of sand and gravel between depths of 20 and 40 inches.

Typic Haplaquolls are poorly drained, dark-colored, noncalcareous to calcareous soils. They have a fluctuating water table that rises near the surface in some season almost every year, and the soils are saturated for long periods. They are characterized by a dark-colored, neutral to moderately alkaline A horizon less than 24 inches thick which, with the exception of the sandy member, is underlain by a mottled B2 horizon of low chroma. The content of organic carbon decreases uniformly with increasing depth. The average annual soil temperature at a depth of 20 inches is less than 47°, and the average soil temperature in summer is more than 58°.

Vertic Haplaquolls are dark-colored, calcareous, fine-textured soils in poorly drained areas. They have a fluctuating water table at or near the surface in some season almost every year and are saturated to a depth of 20 inches for long periods. They are characterized by a dark-colored, calcareous surface horizon high in content of organic matter and a mottled B2 horizon of low chroma. The content of organic carbon decreases uniformly with increasing depth. The clay fraction is dominated by montmorillonitic clay, and the soils shrink and swell on wetting and drying.

Lithic Haploborolls are dark-covered, well-drained, shallow soils that developed in areas where hard bedrock is within a depth of 10 to 20 inches. They are characterized by a moderately dark colored A horizon and a thin C horizon. The content of organic carbon decreases uniformly with increasing depth.

Torriorthentic Haploborolls are dark-colored, mildly alkaline to moderately alkaline, well-drained soils that are calcareous at or near the surface or lack definite horizons of alteration below the dark-colored A horizon. They are characterized by a moderately dark colored A horizon and a light-colored, calcareous C horizon. The content of organic carbon decreases uniformly with increasing depth.

Aridic Argiborolls are medium textured to moderately fine textured, well-drained grassland soils. They are characterized by a moderately dark colored, neutral to slightly acid A horizon over a continuous B2t horizon of silicate clay accumulation. The content of organic carbon decreases uniformly with increasing depth. In areas where the parent material contains free carbonates, continuous horizons of secondary carbonates occur below the solum.

Aridic Lithic Argiborolls are fine-textured, very gravelly, well-drained grassland soils. They are characterized by a moderately dark colored, neutral to slightly acid A horizon and a light-colored, continuous B2t horizon of illuvial silicate clay accumulation that rests on hard bedrock at a depth of 10 to 20 inches. They are more than 35 percent coarse fragments. The average annual soil temperature is less than 47°, and the average soil temperature in summer is 59° or more.

Aridic Pachic Argiborolls are fine-textured, well-drained grassland soils. They are characterized by a moderately dark colored, neutral A horizon, a B2t horizon of illuvial silicate clay accumulation, and a calcareous, medium textured to moderately fine textured C horizon that has weak subhorizons of secondary calcium carbonate accumulation. The dark-colored mollic epipedon in these soils extends to a depth in excess of 20 inches. The average annual soil temperature is less than 47°, and the average soil temperature in summer is 59° or more.

Typic Cryoborolls are medium-textured to fine-textured, well-drained grassland soils. They are characterized by a moderately dark colored, neutral to slightly acid A horizon, a continuous B2 horizon that shows evidence of alteration but lacks silicate clay accumulation, and a medium-textured to fine-textured C horizon. Where the parent material contains free carbonates, subhorizons of secondary carbonate accumulation occur. These subhorizons may be absent where the parent material is noncalcareous. The content of organic carbon decreases uniformly with increasing depth. The average annual soil temperature is less than 47°, and the average soil temperature in summer is less than 59°.

Lithic Cryoborolls are medium textured to moderately coarse textured, well-drained grassland soils. They are characterized by a moderately dark colored, friable, neutral A horizon and a light-colored, calcareous C horizon that has some visible accumulation of calcium carbonate. Hard bedrock is at a depth of 10 to 20 inches. The organic carbon content decreases uniformly with increasing depth. The average annual soil temperature is less than 47°, and the average soil temperature in summer is less than 59°.

Pachic Cryoborolls are very gravelly, moderately coarse textured, well-drained grassland soils. They are characterized by a moderately dark colored, friable, neutral A horizon and a very gravelly, moderately coarse textured, noncalcareous C horizon. The dark-colored mollic epipedon is more than 20 inches thick. The content of organic carbon decreases uniformly with increasing depth. The average annual soil temperature is less than 47°, and the average soil temperature in summer is less than 59°.

Argic Cryoborolls are medium-textured to fine-textured, well-drained grassland soils. They are characterized by a moderately dark colored, neutral to slightly acid A horizon and a B2t horizon of illuvial silicate clay accumulation. The thickness of the mollic epipedon is less than 16 inches. Where the parent material contains free carbonates, secondary carbonate accumulation occurs below the solum. The content of organic carbon decreases uniformly with increasing depth. The average annual soil temperature is less than 47°, and the average soil temperature in summer is less than 59°.

Argic Lithic Cryoborolls are medium textured to moderately fine textured, well-drained grassland soils. They are characterized by a moderately dark colored, neutral A horizon, and a B2t horizon of illuvial silicate clay accumulation. Bedrock is at a depth of 10 to 20 inches. The content of organic carbon decreases uniformly with increasing depth. The average annual soil temperature is less than 47°, and the average soil temperature in summer is less than 59°.

Argic Pachic Cryoborolls are fine-textured, well-drained grassland soils. They are characterized by a moderately dark colored, neutral A horizon, and a B2t horizon of illuvial silicate clay accumulation. In the Gunnison Area they are developing in parent material low in free carbonates. Consequently these soils do not have a visible accumulation of secondary carbonates below the solum. Thickness of the dark-colored mollic epipedon exceeds 16 inches. The content of organic carbon decreases uniformly with increasing depth. The average annual soil temperature is less than 47°, and the average soil temperature in summer is less than 59°.

Abruptic Cryoborolls are fine-textured, well-drained grassland soils. They are characterized by a moderately dark colored, neutral A horizon and a B2t horizon of illuvial silicate clay accumulation. The increase in clay from the A horizon to the top of the B2t horizon is more than 20 percent absolute within a distance of 3 inches or 15 percent absolute within a distance of 1 inch. In the Gunnison Area these soils have horizons of visible secondary carbonates below the solum. The thickness of the mollic epipedon is less than 16 inches. In places a thin, light-colored A2 horizon occurs intermittently just above the B2 horizon. The content of organic carbon decreases uniformly with increasing depth. The average annual soil temperature is less than 47°, and the average soil temperature in summer is less than 59°.

Boralfic Cryoborolls are fine-textured, well-drained soils that formed under grass or timber. They are characterized by a moderately dark colored, neutral to slightly acid Al horizon, a continuous, light-colored, eluvial A2 horizon, and a B2t horizon of illuvial silicate clay accumulation. In the Gunnison Area these soils formed in parent material that was originally low in free carbonates. They do not have horizons of visible secondary carbonate accumulation. The content of organic carbon decreases rapidly and uniformly with increasing depth. The light-colored, eluvial A2 horizon underlying the dark, thick Al horizon and overlying the B2 horizon is the differentiating characteristic of this subgroup.

Pergelic Cryumbrepts are medium textured to moderately fine textured, well-drained grassland soils. They are characterized by a very dark colored, strongly acid A horizon overlying a B2 horizon of brighter chroma or redder hue. The B2 horizon shows evidence of alteration but does not have a distinct concentration of illuvial silicate clay, iron, aluminum, or humus. The content of organic carbon in the surface horizon is as high as 10 to 20 percent and decreases uniformly with increasing depth. Thickness of the dark-colored surface horizon is more than 7 but less than 16 inches. The average annual soil temperature is less than 32°, and the average soil temperature in summer is less than 59°.

Typic Cryoboralfs are medium-textured to fine-textured, well-drained forest soils. They are characterized by a light-colored or thin, dark-colored Al horizon; a distinct and continuous, eluvial A2 horizon; a transitional A and B horizon in which the A2 and B2 material appear to be mixed; and a continuous B2t horizon of illuvial silicate clay accumulation. In the Gunnison Area these soils are strongly acid to neutral in reaction. The content of organic carbon in the Al horizon can range up to as much as 4 percent, but decreases rapidly and uniformly with increasing depth. The average annual soil temperature is less than 47°. In areas where the timber cover is open and the soils do not have a thick organic mat on the surface, the average soil temperature in summer is less than 59°. Where timber stands are dense and the organic mat is thick, the average soil temperature in summer is less than 47° at a depth of 20 inches.

General Nature of the Area

The first white men to visit the Gunnison Area were Spanish explorers from Santa Fe, Captain Juan Maria de Rivera in 1775 and Padre Francisco Escalante in 1776. The name, Gunnison, is in honor of Captain John Gunnison who was searching for a railroad route from the Mississippi River to the Pacific Ocean.

The first settlers were miners, in the early 1870's. Ute Indians hunted and camped in the area and traded with the first white inhabitants. The first permanent settlement was near the present site of Gunnison in 1875.

The Gunnison Area is served by three local newspapers and one radio station. Television is received through repeater stations. Electricity is provided through the generating and delivery systems of the Rural Electric Association.

Numerous narrow gage railroads were built in difficult terrain in the early days to serve the mining

industry. The old railroad grades are still noticeable, but all railroads have disappeared. Many unimproved roads are traveled by jeep. Commercial airline flights are available daily.

Native woodland products were used for railroad ties and mining props. The indiscriminate cutting of trees has adversely affected the production of lumber and forestry products. Recently, scientific methods of harvesting timber have become more widely used. Logs are transported principally by truck to sawmills and wood product centers in Montrose, Delta, and other places where plywood, doors, windows, and numerous other products are produced.

Recreation is an increasing land use in the survey area. Multiple use of land and water resources provides hunting, fishing, camping, picnicking, and other outdoor recreation. Resort owners provide horseback riding and pack trips where people can study and enjoy nature from mountain meadow to alpine slopes. Winter sports are becoming increasingly popular. Many mountain streams and lakes provide several species of mountain trout. Hunters are numerous and harvest many deer, elk, grouse, sagehens, and ducks.

Livestock is transported by highway to the railroad. Commercial markets for livestock are in Denver and Salida, Colorado. A large amount of on-the-ranch buying is done for delivery to feedlot in the Corn Belt States.

Physiography, Relief, and Drainage

The Gunnison Area is a series of open valleys flanked on either side by high mountains. It is the central part of the Southern Rocky Mountains. It is drained by the Gunnison River and its tributaries, the Lake Fork of the Gunnison, the East River, and Ohio, Tomichi, Cebolla, Blue, and Cimarron Creeks. The Gunnison River originates at the town of Almont and flows southwesterly to Gunnison, which is near its confluence with Ohio and Tomichi Creeks. It then flows westerly, enters the Black Canyon of the Gunnison near the site of the Blue Mesa Dam, and leaves the survey area near the Montrose County line.

Nearly level flood plains, low terraces, and alluvial fans are adjacent to major streams and tributaries. The interstream areas consist of moderately rolling to steeply rolling uplands, dissected mesas, and long narrow ridges paralleled by drainageways that slope toward the Gunnison River Valley. In many places the Gunnison River and its tributaries are deeply incised, in narrow canyons as much as 1,000 feet deep. Elevations range from 7,100 feet at the west edge where the Gunnison River leaves the survey area to 12,700 feet on the Cannibal Plateau in northern Hinsdale County. Because slopes are steep and soils are shallow and have low available water capacity, concentrations of runoff from heavy thundershowers and spring snowmelt accumulate in drainageways and cause scouring and rapid cutting of gullies.

Ranching

Markets and outside competition have caused nearly complete discontinuation of farm crops and dairy products. Ranches have increased in number and size and now include nearly all the usable agricultural land. Cow-calf ranching has been the result of these changes. The present trend, generally by nonresident landowners, is toward consolidating ranches into larger, more efficient enterprises.

Meadow grass and clover and hayfields are irrigated (fig. 13). Livestock graze the meadow in spring and after they are removed from the range in fall. Cattle are marketed after grazing the meadow grasses in fall. Sheep graze the range in summer, but are ordinarily wintered at lower elevations.

Many ranches are incorporating recreation into regular ranching. Horses are kept for use on the range and for recreation.

Ranching in the future is likely to trend toward even larger units and summer grazing only and specializing, for example, in registered cattle for beef, horses for recreation, and purebred stock for breeding purposes and for competition at local, State, or national stock shows.

Climate[8]

Low rainfall, short frost-free periods, and low winter temperatures limit the survey area largely to production of native hay, range grasses, and woodland products. Irrigation is needed in maintaining adequate moisture for hay and pasture grasses during periods of low rainfall. Cold soil temperatures and short growing seasons do not allow such crops as sugar beets and corn to mature. Livestock require extra care during periods of extreme cold.

Topographic differences cause wide extremes of climate, both locally and throughout the survey area. Local differences are caused by air drainage, relief, and elevation modified by gradient and aspect.

High pressure areas tend to form in winter and remain stationary for several days. Unless the ground is covered with snow or air drainage is poor, the sky is clear under high pressure systems, daytime temperatures are moderately high and uniform, and nights are very cold. Periods of poor air drainage are common in the vicinity of Gunnison, which is generally colder at such times than Crested Butte. Nighttime temperatures depend largely on topography, where air drainage exerts a greater control than the actual elevation.

Some of the lowest temperature readings are in mountain parks where the air is calm. In these parks the greatest cold is confined to the lower strata of air. The mildest weather during cold spells is below or near the mouths of large canyons.

Most of the precipitation occurs in winter and early in spring. January, February, and March are the months of heaviest snowfall. June is normally dry. Frequent showers occur during the latter part of July and August. Generally, precipitation increases substantially as elevation increases.

Prevailing winds are from the southwest and are frequently strong in winter and spring. Drifting snow accumulates in the more protected places. These snow-

[8] J. W. BERRY, climatologist, National Weather Service, Denver, Colorado.

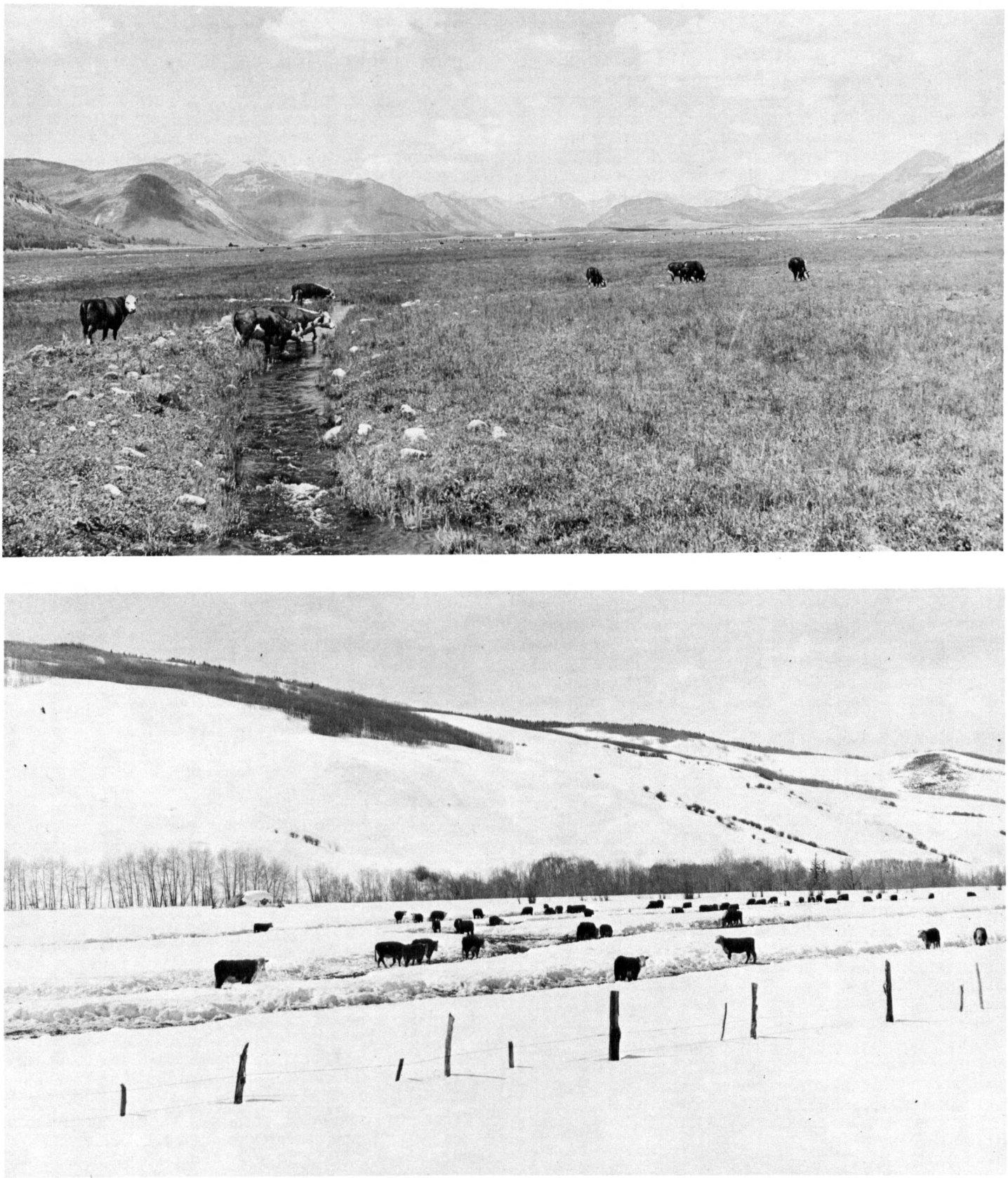

Figure 13.—Top: Irrigated pasture and mountain meadow on Gateview and Fola soils. *Bottom:* Irrigated hay carries livestock through winter.

TABLE 8.—*Temperature and precipitation*

[All data from Gunnison, elevation 7,675 feet]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average total	Two years in 10 will have—		Average number of days with snow cover of 1 inch or more	Average depth of snow on days with snow cover
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—		
	°F	°F	°F	°F	*Inches*	*Inches*	*Inches*		*Inches*
January	28	−5	42	−25	0.97	0.3	1.7	30	6
February	32	−1	46	−23	.98	.5	1.6	27	11
March	42	11	56	−6	.81	.3	1.1	16	8
April	57	23	71	13	.80	.5	1.3	(1)	3
May	67	29	78	21	.76	.4	1.2	(1)	1
June	78	36	86	28	.78	.3	1.4	0	—
July	83	42	89	35	1.47	.9	2.2	0	—
August	81	41	87	32	1.46	.7	2.3	0	—
September	75	31	83	23	.89	.4	1.3	0	—
October	64	22	75	11	.72	.2	1.1	0	—
November	47	10	61	−4	.60	.2	1.0	4	2
December	34	−1	47	−17	.76	.2	1.0	14	4
Year	57	20	[2] 90	[3] −31	11.00	8.2	12.4	91	7

[1] Less than one-half day. [2] Average annual highest temperature. [3] Average annual lowest temperature.

drifts are the last to melt; and thus retard runoff, which allows more even distribution of streamflow in spring and summer. At elevations above timberline some large snowdrifts remain throughout most of the summer. Warming trends in May and June are the periods of greatest runoff. During this time streams are at a peak and overflow on flood plains and lowlands along major drainageways.

Climatic summaries are shown in tables 8 and 9.

Literature Cited

(1) AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS.
1956. STANDARD SPECIFICATIONS FOR HIGHWAY MATERIALS AND METHODS OF SAMPLING AND TESTING. Ed. 7, 2 v., illus.

(2) BALDWIN, M., KELLOGG, C. C., and THORP, J.
1938. SOIL CLASSIFICATION. U.S. Dept. Agr. Ybk., pp. 979–1001, illus.

(3) SIMONSON, ROY W.
1962. SOIL CLASSIFICATION IN THE UNITED STATES. Sci. 137: 1027–1034, illus.

(4) UNITED STATES DEPARTMENT OF AGRICULTURE.
1951. SOIL SURVEY MANUAL. U.S. Dept. Agr. Handbook No. 18, 503 pp., illus.

(5) ———
1960. SOIL CLASSIFICATION, A COMPREHENSIVE SYSTEM, 7TH APPROXIMATION. 265 pp., illus. [Supplements issued in March 1967 and September 1968]

(6) ———
1961. LAND CAPABILITY CLASSIFICATION. U.S. Dept. Agr. Handbook No. 210, 21 pp.

(7) UNITED STATES DEPARTMENT OF DEFENSE.
1968. UNIFIED SOIL CLASSIFICATION SYSTEM FOR ROADS, AIRFIELDS, EMBANKMENTS AND FOUNDATIONS. MIL-STD-619B, 30 pp., illus.

TABLE 9.—*Probabilities of last freezing temperatures in spring and first in fall*

[All data from Gunnison, elevation 7,675 feet]

Probability	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than	May 6	May 20	June 8	June 25	July 12
2 years in 10 later than	Apr. 30	May 14	June 2	June 19	July 6
5 years in 10 later than	Apr. 18	May 3	May 21	June 7	June 24
Fall:					
1 year in 10 earlier than	Sept. 27	Sept. 18	Sept. 7	Aug. 26	Aug. 12
2 years in 10 earlier than	Oct. 3	Sept. 23	Sept. 12	Aug. 31	Aug. 17
5 years in 10 earlier than	Oct. 13	Oct. 2	Sept. 21	Sept. 10	Aug. 26
Average number of days between last occurrence in spring and first in fall	178	153	123	95	63

Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Basalt. A fine-grained, dark-colored igneous rock.

Base course (engineering). In road construction, selected material of planned thickness used as a foundation for pavement.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Blanket (engineering). A thin layer of clayey soil or other slowly permeable material placed on the upstream floor of an embankment to retard the seepage of water.

Breccia. A fragmental rock with angular components and, therefore, as distinguished from conglomerate, not waterworn.

Calcareous, soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Coarse-textured soil. Sand and loamy sand.

Complex, soil. A mapping unit consisting of different kinds of soils that occur in such small individual areas or in such an intricate pattern that they cannot be shown separately on a publishable soil map.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Deferred grazing. The practice of delaying grazing until range plants have reached a definite stage of growth, in order to increase the vigor of the forage and to allow the desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Fine-textured soils. Roughly, soils that contain 35 percent or more of clay. *Moderately fine textured*: Clay loam, sandy clay loam, silty clay loam. *Fine-textured*: Sandy clay, silty clay, and clay.

Forage. Plant material that can be used as feed by domestic animals; it may be grazed or cut for hay.

Forb. Any herbaceous plant, neither a grass nor a sedge, that is grazed on western range.

Gleyed soil. A soil in which waterlogging and lack of oxygen have caused the material in one or more horizons to be neutral gray in color. The term "gleyed" is applied to soil horizons with yellow and gray mottling caused by intermittent waterlogging.

Gneiss. A coarse-grained, laminated or foliated metamorphic rock.

Granite. A light-colored, coarse-grained igneous rock.

Habitat. The natural abode of a plant or animal; it refers to the kind of environment in which a plant or animal normally lives as opposed to its range, or geological distribution.

Heavy soil. An old term formerly used for clayey or fine-textured soils.

Herb. A plant that dies annually or after flowering; grasses and forbs, as distinguished from shrubs and trees.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Igneous rock. Rock that has been formed by the cooling of molten mineral material. Examples: Granite, syenite, diorite, and gabbro.

Leaching. The removal of soluble materials from soils or other material by percolating water.

Legume. A member of the legume or pulse family (*Leguminosae*), one of the most important and widely distributed plant families. Many valuable forage species, such as peas, beans, peanuts, clover, alfalfa, sweet clover, lespedeza, vetch, and kudzu are included. Practically all legumes are nitrogen-fixing plants, and many of the herbaceous species are used as cover and green-manure crops. Even some of the legumes that have no forage value (crotalaria and some lupines) are used for soil improvement. Other legumes are locust, honeylocust, redbud, mimosa, wisteria, and many tropical plants.

Mapping unit. Areas of soil of the same kind outlined on the soil map and identified by a symbol.

Medium-textured soil. Soil of very fine sandy loam, loam, silt loam, or silt texture.

Metamorphic rocks. Rocks of any origin that have been completely changed physically by heat, pressure, and movement. Such rocks are nearly always crystalline.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, dis-*

tinct, and *prominent*. The size measurements are these: *fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Organic matter. A general term for plant and animal material, in or on the soil, in all stages of decomposition. Readily decomposed organic matter is often distinguished from the more stable forms that are past the stage of rapid decomposition.

Overgrazing. Grazing so heavy as to impair future forage production and to deteriorate plants, soil, or both. Contrasts with undergrazing.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Percolation. The downward movement of water through the soil.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Range (or rangeland). Land that, for the most part, produces native plants suitable for grazing by livestock; includes land on which there are some forest trees.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rotation grazing. Grazing two or more pastures, or parts of a range, in regular order, with definite recovery periods between grazing periods. Contrasts with continuous grazing.

Runoff (hydraulics). The part of the precipitation upon a drainage area that is discharged from the area in stream channels. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called groundwater runoff or seepage flow from ground water.

Rhyolite. A very acid, generally fine-grained igneous rock that is the lava form of granite.

Saline soil. A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Sandstone. A sedimentary rock composed of cemented sand grains.

Schist. A foliated, crystalline, metamorphic rock that readily splits into slabs or sheets.

Sedimentary rock. A rock composed of particles deposited from suspension in water. The chief sedimentary rocks are conglomerate, from gravel; sandstone, from sand; shale, from clay; and limestone, from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sands have been consolidated into sandstone.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Shale. A sedimentary rock formed by the hardening of clay deposits.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Stratified. Composed of, or arranged in, strata, or layers, such as stratified alluvium. The term is confined to geological material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subgrade (engineering). The substratum, consisting of inplace material or fill material, that is prepared for highway construction; does not include stabilized base course or actual paving material.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Tuff. Deposited volcanic ash, normally more or less stratified and consolidated.

Upland (geology). Land consisting of material unworked by water in recent geologic time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowlands along rivers.

Weathering. All physical and chemical changes produced in rocks at or near the earth's surface by atmospheric agents. These changes result in more or less complete disintegration and decomposition of the rock.

GUIDE TO MAPPING UNITS

For complete information about a mapping unit, read both the description of the mapping unit and that of the soil series to which it belongs. Woodland groups are described on pages 52 and 53. Additional information is given in tables as follows:

Acreage and extent, table 1, page 9.
Predicted yields, table 2, page 43.

Engineering, table 5, page 56 and table 6, page 62.

Map symbol	Mapping unit	Page	Capability unit				Range site		Woodland
			Irrigated		Nonirrigated				
			Symbol	Page	Symbol	Page	Name	Page	Number
Ad	Alluvial land	8	-----	--	VIw-3	42	Mountain Swale	48	--
Ao	Alluvial land, occasionally flooded	8	-----	--	VIIw-4	42	----------	--	--
Aw	Alluvial land, wet	8	VIw-1	41	-----	--	Mountain Meadow	47	--
BaF	Bead fine sandy loam, 10 to 50 percent slopes	10	-----	--	VIIe-2	42	----------	--	3
BbA	Big Blue loam, 0 to 1 percent slopes	10	Vw-1	40	-----	--	----------	--	--
BbB	Big Blue loam, 1 to 5 percent slopes	10	Vw-2	40	-----	--	----------	--	--
BoE	Bogan silt loam, 5 to 30 percent slopes	11	VIe-1	41	VIe-4	41	Subalpine Loam	48	--
BsB	Bosler sandy loam, 1 to 8 percent slopes	11	Vc-1	40	VIe-2	41	Mountain Outwash	46	--
CaF	Carbol very rocky sandy loam, 15 to 60 percent slopes	12	-----	--	VIIs-2	42	----------	--	1
CeE	Cebolia loam, 5 to 30 percent slopes	13	-----	--	VIe-4	41	Subalpine Loam	48	--
CoE	Cochetopa loam, 5 to 30 percent slopes	13	VIe-1	41	VIe-4	41	Subalpine Loam	48	--
CrE	Corpening fine sandy loam, 5 to 40 percent slopes	14	-----	--	VIIs-1	42	Dry Mountain Loam	44	--
CuB	Curecanti gravelly loam, 1 to 8 percent slopes	14	VIs-1	41	VIe-2	41	Mountain Outwash	46	--
DeB	Dewville loam, 1 to 5 percent slopes	15	Vc-1	40	VIe-2	41	Mountain Outwash	46	--
DeC	Dewville loam, 5 to 15 percent slopes	15	VIe-1	41	VIe-2	41	Mountain Outwash	46	--
DoE	Dollard silty clay loam, 5 to 30 percent slopes	15	VIe-1	41	VIIe-1	42	Deep Clay Loam	48	--
DrE	Duffson-Corpening loams, 5 to 35 percent slopes	16	-----	--	VIe-5	41	----------	--	--
	Duffson soil	--	-----	--	-----	--	Mountain Loam	45	--
	Corpening soil	--	-----	--	-----	--	Dry Mountain Loam	44	--
DsE	Duffson-Spring Creek stony loams, 5 to 40 percent slopes	16	-----	--	VIIs-1	42	----------	--	--
	Duffson soil	--	-----	--	-----	--	Mountain Loam	45	--
	Spring Creek soil	--	-----	--	-----	--	Dry Mountain Loam	44	--
EvB	Evanston loam, 1 to 5 percent slopes	17	Vc-1	40	VIe-2	41	Mountain Outwash	46	--
EvD	Evanston loam, 5 to 20 percent slopes	17	VIe-1	41	VIe-2	41	Mountain Outwash	46	--
FoB	Fola cobbly sandy loam, 1 to 8 percent slopes	17	VIs-1	41	VIe-2	41	Mountain Outwash	46	--
GaA	Gas Creek sandy loam, 0 to 1 percent slopes	18	Vw-1	40	-----	--	----------	--	--

☆ U.S. GOVERNMENT PRINTING OFFICE: 1975— 576-467/93

Map symbol	Mapping unit	Page	Capability unit Irrigated Symbol	Irrigated Page	Nonirrigated Symbol	Nonirrigated Page	Range site Name	Range site Page	Woodland Number
GaB	Gas Creek sandy loam, 1 to 5 percent slopes	18	VIs-1	41	-----	--	----------	--	--
GeB	Gateview cobbly loam, 2 to 8 percent slopes	19	VIs-1	41	VIe-2	41	Subalpine Loam	48	--
GeE	Gateview cobbly loam, 8 to 30 percent slopes	19	VIe-1	41	VIIs-1	42	Subalpine Loam	48	--
GrB	Gold Creek silty clay loam, 0 to 5 percent slopes	19	Vw-3	40	-----	--	----------	--	--
IrA	Irim loam, 0 to 1 percent slopes	20	Vw-1	40	-----	--	----------	--	--
IrB	Irim loam, 1 to 5 percent slopes	20	Vw-2	40	-----	--	---------	--	--
JeE	Jerry loam, 5 to 30 percent slopes	21	VIe-1	41	VIe-4	41	Subalpine Loam	48	--
KcE	Kezar-Cathedral gravelly sandy loams, 5 to 35 percent slopes	21	-----	--	VIe-5	41	----------	--	--
	Kezar soil	--	-----	--	-----	--	Mountain Loam	45	--
	Cathedral soil	--	-----	--	-----	--	Dry Mountain Loam	44	--
KuE	Kubler loam, 5 to 35 percent slopes	22	VIe-1	41	VIe-4	41	Subalpine Loam	48	--
LeE	Leaps silty clay loam, 5 to 30 percent slopes	22	-----	--	VIIe-1	42	Deep Clay Loam	48	--
LhF	Lucky-Cheadle gravelly sandy loams, 5 to 45 percent slopes	23	-----	--	VIIe-3	42	----------	--	--
	Lucky soil	--	-----	--	-----	--	Mountain Loam	45	--
	Cheadle soil	--	-----	--	-----	--	Dry Mountain Loam	44	--
MeF	Meredith very stony loam, 8 to 50 percent slopes	23	-----	--	VIIs-3	43	Alpine Slopes	50	--
MoE	Mord loam, 5 to 30 percent slopes	24	VIe-1	41	VIe-4	41	Subalpine Loam	48	--
MrE	Morop stony loam, 5 to 40 percent slopes	25	VIe-1	41	VIIs-1	42	Mountain Loam	45	--
NuF	Nutras stony loam, 10 to 50 percent slopes	26	-----	--	VIIe-2	42	----------	--	4
PhF	Parlin-Hopkins channery loams, 5 to 45 percent slopes	26	-----	--	VIIe-3	42	----------	--	--
	Parlin soil	--	-----	--	-----	--	Mountain Loam	45	--
	Hopkins soil	--	-----	--	-----	--	Dry Mountain Loam	44	--
PmF	Parlin-Mergel gravelly loams, 5 to 45 percent slopes	26	-----	--	VIIe-3	42	----------	--	--
	Parlin soil	--	-----	--	-----	--	Mountain Loam	45	--
	Mergel soil	--	-----	--	-----	--	Dry Mountain Loam	44	--
PoF	Posant very rocky loam, 10 to 60 percent slopes	27	-----	--	VIIs-2	42	----------	--	1
PwE	Powderhorn loam, 5 to 30 percent slopes	28	-----	--	VIe-4	41	Subalpine Loam	48	--
RcE	Redcloud channery loam, 3 to 30 percent slopes	29	VIe-1	41	VIe-2	41	Mountain Outwash	46	--
Ro	Rock outcrop	29	-----	--	VIIIs-1	43	----------	--	--
Rs	Rockslides	29	-----	--	VIIIs-2	43	----------	--	--
RuE	Ruby gravelly sandy loam, 5 to 30 percent slopes	29	-----	--	VIIe-3	42	Shallow Subalpine	49	--

Map symbol	Mapping unit	Page	Capability unit Irrigated Symbol	Irrigated Page	Nonirrigated Symbol	Nonirrigated Page	Range site Name	Range site Page	Woodland Number
RyE	Ruby extremely rocky sandy loam, 5 to 40 percent slopes	30	-----	--	VIIe-3	42	Shallow Subalpine	49	--
SsF	Shule and Sapinero loams, 10 to 50 percent slopes	31	-----	--	VIIe-2	42	----------	--	4
St	Stony rock land	31	-----	--	VIIIs-3	43	----------	--	--
SuE	Sunshine loam, 5 to 35 percent slopes	32	-----	--	VIe-4	41	Subalpine Loam	48	--
TrF	Tongue River loam, 10 to 50 percent slopes	33	-----	--	VIIe-2	42	----------	--	4
UtF	Uinta and Tolvar soils, 10 to 50 percent slopes	34	-----	--	VIIe-2	42	----------	--	2
VuE	Vulcan gravelly sandy loam, 10 to 35 percent slopes	34	-----	--	VIIe-2	42	----------	--	3
WeF	Wetterhorn stony loam, 10 to 55 percent slopes	35	-----	--	VIIe-2	42	----------	--	3
WoF	Woodhall extremely rocky loam, 5 to 50 percent slopes	35	-----	--	VIIs-2	42	----------	--	1
WvF	Woosley very rocky loam, 10 to 60 percent slopes	36	-----	--	VIIe-2	42	----------	--	1
YgE	Youga loam, 3 to 30 percent slopes	37	-----	--	VIe-4	41	Subalpine Loam	48	--
YlE	Youman-Leaps loams, 5 to 35 percent slopes	37	-----	--	VIe-4	41	----------	48	--
	Youman soil	--	-----	--	-----	--	Subalpine Loam	--	--
	Leaps soil	--	-----	--	-----	--	Deep Clay Loam	--	--
YpE	Youman-Passar loams, 5 to 30 percent slopes	37	-----	--	VIe-4	41	Subalpine Loam	48	--

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

COLORADO AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

GUNNISON AREA, COLORADO

PARTS OF GUNNISON, HINSDALE, AND SAGUACHE COUNTIES

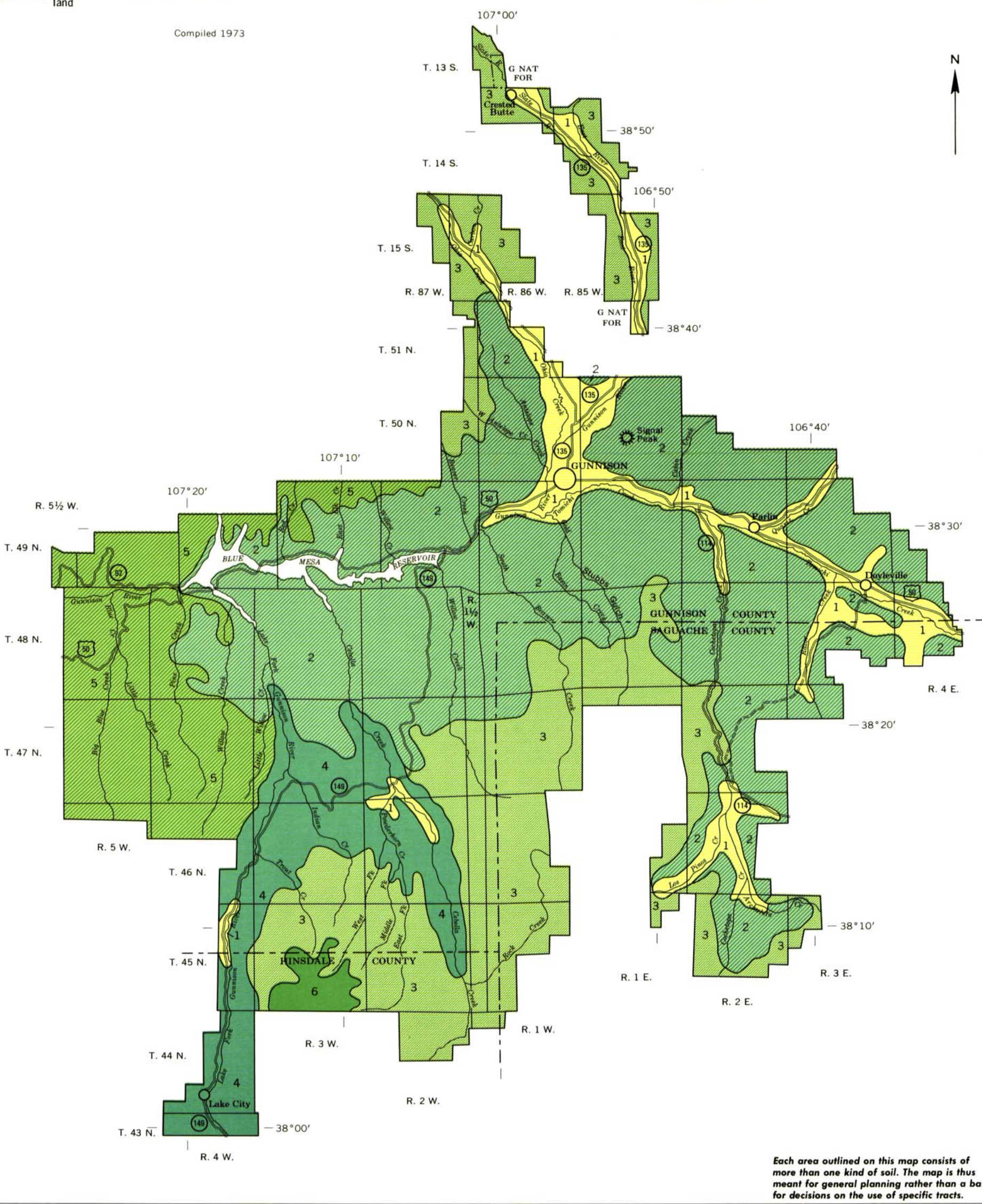
Scale 1:380,160

1 0 1 2 3 4 5 6 Miles

Compiled 1973

SOIL ASSOCIATIONS

1. Evanston-Gas Creek-Irim association: Deep, nearly level to strongly sloping, well-drained, somewhat poorly drained, and poorly drained loams and sandy loams on flood plains, terraces, and alluvial fans
2. Parlin-Lucky- Hopkins association: Deep and moderately deep, moderately sloping to steep, well-drained channery loams and gravelly sandy loams on hills, mountains, ridges, and benches
3. Vulcan-Wetterhorn-Ruby association: Deep and moderately deep, moderately sloping to steep, well-drained gravelly sandy loams and stony loams on mountains, ridges, and mesas
4. Posant-Woodhall-Stony rock land association: Shallow and moderately deep, moderately sloping to very steep, well-drained gravelly loams and stony and rocky areas on mountains, hills, and ridges
5. Shule-Youman-Passar association: Moderately deep and deep, strongly sloping to steep, well-drained loams on alluvial fans, hills, ridges and mountains
6. Meredith-Rockslides association: Deep, stony, well-drained, strongly sloping to very steep soils and rockslides on mountain and alpine rimland



Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

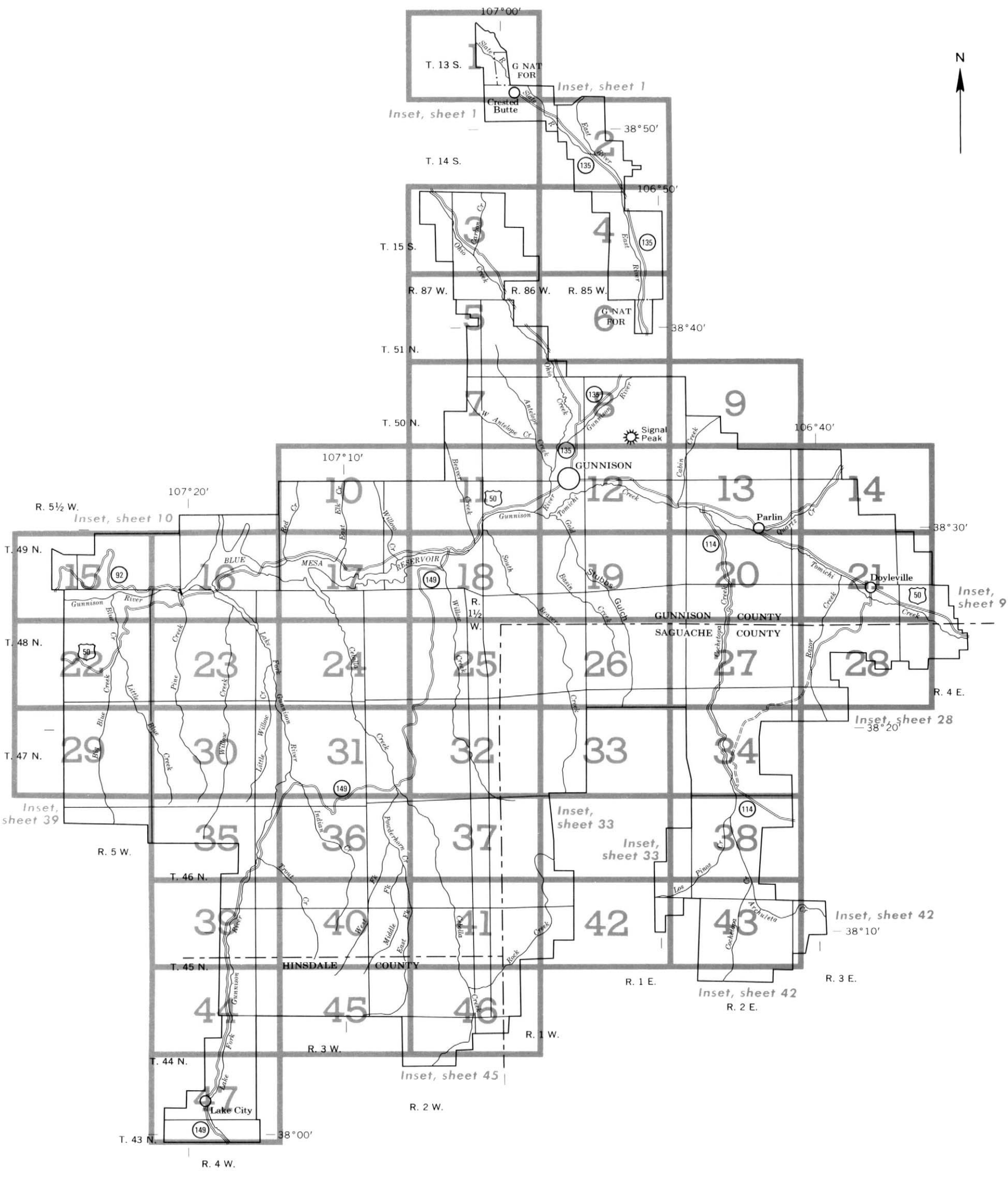
INDEX TO MAP SHEETS

GUNNISON AREA, COLORADO

PARTS OF GUNNISON, HINSDALE, AND SAGUACHE COUNTIES

Scale 1:380,160

1 0 1 2 3 4 5 6 Miles



SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, shows the slope. Most symbols without a slope letter are those of nearly level soils, but some are for land types that have a considerable range in slope.

SYMBOL	NAME
Ad	Alluvial land
Ao	Alluvial land, occasionally flooded
Aw	Alluvial land, wet
BaF	Bead fine sandy loam, 10 to 50 percent slopes
BbA	Big Blue loam, 0 to 1 percent slopes
BbB	Big Blue loam, 1 to 5 percent slopes
BoE	Bogan silt loam, 5 to 30 percent slopes
BsB	Bosler sandy loam, 1 to 8 percent slopes
CaF	Carbal very rocky sandy loam, 15 to 60 percent slopes
CeE	Cebolla loam, 5 to 30 percent slopes
CoE	Cochetopa loam, 5 to 30 percent slopes
CrE	Carpening fine sandy loam, 5 to 40 percent slopes
CuB	Curecanti gravelly loam, 1 to 8 percent slopes
DeB	Dewville loam, 1 to 5 percent slopes
DeC	Dewville loam, 5 to 15 percent slopes
DoE	Dollard silty clay loam, 5 to 30 percent slopes
DrE	Duffson-Carpening loams, 5 to 35 percent slopes
DsE	Duffson-Spring Creek stony loams, 5 to 40 percent slopes
EvB	Evanston loam, 1 to 5 percent slopes
EvD	Evanston loam, 5 to 20 percent slopes
FoB	Fola cobbly sandy loam, 1 to 8 percent slopes
GaA	Gas Creek sandy loam, 0 to 1 percent slopes
GaB	Gas Creek sandy loam, 1 to 5 percent slopes
GeB	Gateview cobbly loam, 2 to 8 percent slopes
GeE	Gateview cobbly loam, 8 to 30 percent slopes
GrB	Gold Creek silty clay loam, 0 to 5 percent slopes
IrA	Irim loam, 0 to 1 percent slopes
IrB	Irim loam, 1 to 5 percent slopes
JeE	Jerry loam, 5 to 30 percent slopes
KcE	Kezar-Cathedral gravelly sandy loams, 5 to 35 percent slopes
KuE	Kubler loam, 5 to 35 percent slopes
LeE	Leaps silty clay loam, 5 to 30 percent slopes
LhF	Lucky-Cheadle gravelly sandy loams, 5 to 45 percent slopes
MeF	Meredith very stony loam, 8 to 50 percent slopes
MoE	Mord loam, 5 to 30 percent slopes
MrE	Morop stony loam, 5 to 40 percent slopes
NuF	Nutras stony loam, 10 to 50 percent slopes
PhF	Parlin-Hopkins channery loams, 5 to 45 percent slopes
PmF	Parlin-Mergel gravelly loams, 5 to 45 percent slopes
PoF	Posant very rocky loam, 10 to 60 percent slopes
PwE	Powderhorn loam, 5 to 30 percent slopes
RcE	Redcloud channery loam, 3 to 30 percent slopes
Ro	Rock outcrop
Rs	Rockslides
RuE	Ruby gravelly sandy loam, 5 to 30 percent slopes
RyE	Ruby extremely rocky sandy loam, 5 to 40 percent slopes
SsF	Shule and Sapinero loams, 10 to 50 percent slopes
St	Stony rock land
SuE	Sunshine loam, 5 to 35 percent slopes
TrF	Tongue River loam, 10 to 50 percent slopes
UtF	Uinta and Tolvar soils, 10 to 50 percent slopes
VuE	Vulcan gravelly sandy loam, 10 to 35 percent slopes
WeF	Wetterhorn stony loam, 10 to 55 percent slopes
WoF	Woodhall extremely rocky loam, 5 to 50 percent slopes
WvF	Woosley very rocky loam, 10 to 60 percent slopes
YgE	Youga loam, 3 to 30 percent slopes
YlE	Youman-Leaps loams, 5 to 35 percent slopes
YpE	Youman-Passar loams, 5 to 30 percent slopes

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Limit of detailed soil survey
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals and ditches

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

Short steep slope

Prominent peak

Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness: Stony; Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully
- Saline spot

GUNNISON AREA, COLORADO — SHEET NUMBER 1

GUNNISON AREA, COLORADO NO. 1

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station
Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.
Land division corners are approximately positioned on this map.

1 550 000 FEET

400 000 FEET

INSET B

R. 86 W.

1 585 000 FEET

T. 14 S. (Joins lower right)

381 000 FEET

379 000 FEET

1 588 000 FEET

(Joins sheet 2)

2 000 AND 3 000-FOOT GRID TICKS

INSET A

(Joins lower right)

R. 86 W.

1 580 000 FEET

T. 14 S.

378 000 FEET

(Joins sheet 2)

373 000 FEET

1 570 000 FEET

5 000 AND 10 000-FOOT GRID TICKS

T. 14 S., R. 86 W. (Joins inset A)

T. 13 S.

1 580 000 FEET

380 000 FEET (Joins inset B)

N

3 Miles

15 000 Feet

10 000

5000

Scale 1:31 680

GUNNISON AREA, COLORADO — SHEET NUMBER 2

(2)

N

(Joins inset B, sheet 1)

R. 86 W. | R. 85 W.

(Joins inset C)

1 620 000 FEET

(Joins inset A, sheet 1)

T. 14 S.

1 600 000 FEET

R. 85 W.

383 000 FEET

INSET C

GUNNISON NATIONAL FOREST BOUNDARY

LIMIT OF SOIL SURVEY

380 000 FEET

T. 14 S.

1 605 000 FEET

(Joins upper right)

3 000 AND 5 000-FOOT GRID TICKS

1 370 000 FEET

360 000 FEET

(Joins sheet 4)

1 590 000 FEET

Slate River

East River

Farris Creek

Cement Creek

Ohio Creek

GUNNISON NAT FOR

LIMIT OF SOIL SURVEY

NATIONAL FOREST BOUNDARY

GUNNISON

135

Scale 1:31 680

3 Miles 2 1 0 15000 Feet 10000 5000

¾ ½ ¼ 0 1000 2000 3000 4000 5000 Feet

Land division corners are approximately positioned on this map.

Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.

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GUNNISON AREA, COLORADO NO. 2

GUNNISON AREA, COLORADO — SHEET NUMBER 3

GUNNISON AREA, COLORADO NO. 3

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Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.
Land division corners are approximately positioned on this map.

1 550 000 FEET

350 000 FEET

T. 15 S.

R. 87 W. | R. 86 W.

1 580 000 FEET

(Joins sheet 5)

3

N

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31 680

330 000 FEET

5 000 4 000 3 000 2 000 1 000 0

(4)

N

3 Miles 2 1 0 15000 Feet 10000 5000

Scale 1:31 680

1 5000 4000 3000 2000 1000 0 5000

¼ ½ ¾ 1

(Joins sheet 2)

1 620 000 FEET

350 000 FEET

T. 15 S. | T. 14 S.

330 000 FEET

1 590 000 FEET

R. 85 W.

(Joins sheet 6)

32 33 34 4 3 10 11 12 15 14 13 22 23 24 27 26 25

NuF TrF CoE Aw EvB FoB Ao GeE KcE Ro BoE BaF St CeE LeE GaA IrA DeC JeE DoE EvD DrE

Overstreet Gulch Alkali Creek Roaring Judy Creek Jacks Cabin

GUNNISON NATIONAL FOREST BOUNDARY

GUNNISON LIMIT OF NATIONAL FOREST SOIL SURVEY BOUNDARY

Land division corners are approximately positioned on this map.

Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

GUNNISON AREA, COLORADO NO. 4

GUNNISON AREA, COLORADO NO. 5

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Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.
Land division corners are approximately positioned on this map.

1 550 000 FEET

320 000 FEET

R. 86 W.

(Joins sheet 3)

T. 51 N. | T. 15 S.

R. 2 W. | R. 1 W.

(Joins sheet 6)

(Joins sheet 7)

1 580 000 FEET

300 000 FEET

LIMIT OF SOIL SURVEY

GUNNISON NATIONAL FOREST BOUNDARY

Ohio Creek

Willow Creek

Mill Creek

Cunningham Gulch

Cunningham Reservoir

Kenny Moore Reservoir

Antelope Creek

TrF BoE MoE LeE EvD DoE Ao IrB EvB CoE GaA MrE LeE BbB FoB St WeF DsE IrA

5

N

3 Miles 2 1 0

15000 Feet 10 000 5000 0

1 ¼ ½ ¾ 1

5000 4000 3000 2000 1000 0

Scale 1:31 680

(6)

N

Scale 1:31 680

3 Miles 2 1 0 5000 Feet 10 000 5000 0 1000 2000 3000 4000 5000

R. 85 W.

(Joins sheet 4)

1 620 000 FEET

1 320 000 FEET

1 300 000 FEET

1 590 000 FEET

(Joins sheet 5)

(Joins sheet 8)

R. 1 W.

T. 51 N.

T. 51 N. | T. 15 S.

R. 1 E.

GUNNISON NATIONAL FOREST BOUNDARY

LIMIT OF SOIL SURVEY

GUNNISON NATIONAL FOREST LIMIT OF SOIL SURVEY

Roaring Judy Fish Hatchery

Ohio Creek

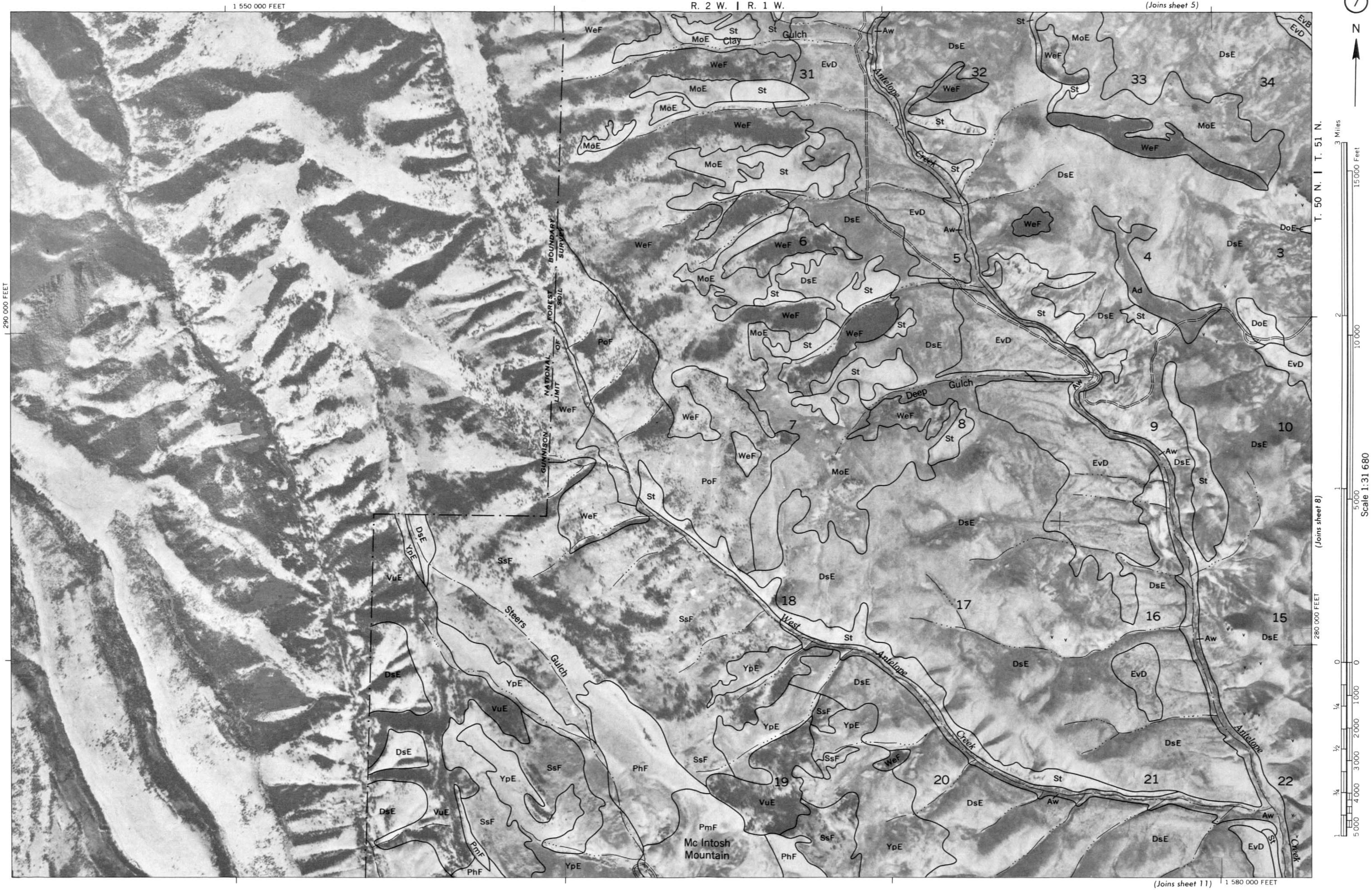
Tank

Land division corners are approximately positioned on this map.

Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

GUNNISON AREA, COLORADO NO. 6



GUNNISON AREA, COLORADO NO. 7

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station. Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone. Land division corners are approximately positioned on this map.

Scale 1:31 680

3 Miles 15 000 Feet

Land division corners are approximately positioned on this map.
Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

GUNNISON AREA, COLORADO NO. 8

GUNNISON AREA, COLORADO NO. 9

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.
Land division corners are approximately positioned on this map.

1 630 000 FEET

1 705 000 FEET

290 000 FEET

230 000 FEET

T. 50 N.

T. 48 N.

(Joins sheet 8)

(Joins sheet 21)

(Joins sheet 28)

GUNNISON NATIONAL FOREST BOUNDARY

LIMIT OF SOIL SURVEY

GUNNISON NATIONAL FOREST BOUNDARY

SOIL SURVEY LIMIT

GUNNISON NATL FOR BDY

GUNNISON CO — SAGUACHE CO

Sheep Gulch

Cabin Creek

Tomichi Creek

Needle Creek

Owens Creek

St

BaF

DrE

JeE

PmF

LhF

YgE

MoE

VuE

PhF

UtF

DeB

DsE

GrB

IrA

IrB

BbA

GaA

BbB

CuB

GaB

DoE

KcE

DeC

EvD

1

4

9

12

13

16

15

18

17

21

22

24

19

20

50

R. 1 E. | R. 2 E.

(Joins sheet 13)

1 640 000 FEET

1 710 000 FEET

210 000 FEET

280 000 FEET

5 000 AND 10 000-FOOT GRID TICKS

N

3 Miles

15 000 Feet

10 000

5 000

4 000

3 000

2 000

1 000

Scale 1:31 680

N

3 000 AND 10 000-FOOT GRID TICKS

GUNNISON NATIONAL FOREST BOUNDARY — 1 480 000 FEET — R. 4 W. — LIMIT OF SOIL SURVEY — GUNNISON NATIONAL FOREST BOUNDARY

253 000 FEET

T. 49 N.

250 000 FEET

Saddle Creek

BLUE MESA RESERVOIR

Elk Creek

West Elk

Dillon Mesa

SsF YpE St KuE PhF RuE

18 17 16 15 14 13

(Joins sheet 16)

(Joins lower left)

1 500 000 FEET

1 510 000 FEET — GUNNISON NATIONAL FOREST BOUNDARY — LIMIT OF SOIL SURVEY — R. 3 W. | R. 2 W.

260 000 FEET

T. 49 N.

250 000 FEET

RuE YpE St VuE SuE PhF DsE MoE WeF Ad Aw EvD

6 5 4 3 2 1 7 8 9 10 11 12 18 17 16 15 14 13

Red Creek

Dry Gulch

East Dry Gulch

Bear Gulch

East Elk Creek

West Fork Dry Creek

East Fork Dry Creek

Dry Cr.

Main Gulch

Willow Creek

Spring Gulch

Stevens Creek

Tenderfoot Hill

(Joins inset)

(Joins sheet 11)

(Joins sheet 17)

1 540 000 FEET

3 Miles 15 000 Feet 10 000

Scale 1:31 680

5 000 4 000 3 000 2 000 1 000 0

¾ ½ ¼ 0

1 5 000

Land division corners are approximately positioned on this map.

Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

GUNNISON AREA, COLORADO NO. 10

GUNNISON AREA, COLORADO — SHEET NUMBER 11

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.
Land division corners are approximately positioned on this map.

GUNNISON AREA, COLORADO NO. 11

1 550 000 FEET

(Joins sheet 7)

11

N

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31 680

T. 49 N. | T. 50 N.

270 000 FEET

GUNNISON NATIONAL FOREST BOUNDARY

LIMIT OF SOIL SURVEY

(Joins sheet 10)

(Joins sheet 12)

250 000 FEET

R. 2 W.

R. 1 W.

(Joins sheet 18)

1 580 000 FEET

Blinberry Gulch

Steers Gulch

Beaver Creek

Sun Creek

Steuben Creek

Aw

Tomichi Creek

GUNNISON RIVER

Beaver Cr.

50

GUNNISON AREA, COLORADO — SHEET NUMBER 12

(Joins sheet 8)

(Joins sheet 11)

(Joins sheet 13)

(Joins sheet 19)

N

Scale 1:31 680

3 Miles

15 000 Feet

10 000

5 000

0

1000

2000

3000

4000

5000

Land division corners are approximately positioned on this map.

Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

GUNNISON AREA, COLORADO NO 13

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.
Land division corners are approximately positioned on this map.

(Joins sheet 12)
(Joins sheet 9)
(Joins sheet 20)

R. 1 E. | R. 2 E.

1 630 000 FEET

270 000 FEET

250 000 FEET

1 660 000 FEET

T. 50 N.

T. 49 N.

GUNNISON NATIONAL FOREST BOUNDARY
LIMIT OF SOIL SURVEY

13

N

Scale 1:31 680

3 Miles 2 1 0

15 000 Feet 10 000 5 000 0

1 ¾ ½ ¼ 0

5 000 4 000 3 000 2 000 1 000 0

Cabin Creek
East Cabin Creek
Dry Gulch
Tomichi Creek
Cochetopa Creek
Sewell Gulch
Alder Creek
Quartz Creek
Long Gulch
Parlin

N

Scale 1:31 680

3 Miles 2 1 0 15000 Feet 10000 5000

1 700 000 FEET

270 000 FEET

250 000 FEET

1 670 000 FEET

GUNNISON NATIONAL FOREST BOUNDARY

LIMIT OF SOIL SURVEY

T. 50 N.

T. 49 N.

R. 3 E. | R. 4 E.

30 29 28 31 32 33 6 5 4 3 7 8 9 10 18 17 16 15 14 13

Big Gulch · Spring Gulch · Quartz Creek · Wood Gulch

KcE · St · Ad · IrB · FoB · DeC · UtF · LhF · GaA · GaB · BbB · DrE · IrA · PhF · VuE · PmF

(Joins sheet 13)

(Joins sheet 21)

Land division corners are approximately positioned on this map.

Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

GUNNISON AREA, COLORADO NO. 14

GUNNISON AREA, COLORADO — SHEET NUMBER 15

GUNNISON AREA, COLORADO NO. 15

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.
Land division corners are approximately positioned on this map.

1 430 000 FEET

1 240 000 FEET

R. 6 W. | R. 5 W. | R. 5½ W. | R. 5 W.

T. 49 N.

T. 48 N.

1 230 000 FEET

1 460 000 FEET

(Joins sheet 16)

(Joins sheet 22)

GUNNISON NATIONAL FOREST BOUNDARY SURVEY LIMIT OF SOIL SURVEY

LIMIT OF SOIL SURVEY

Mesa
Black
Gulch
Johnson
Meyers
Gulch
Creek
Creek
Creek
Creek
Creek
Corral
Creek
Round
Corral
Creek
Houpress
Creek
Aw
Aw
Curecanti Needle
GUNNISON RIVER
CURECANTI
Blue

SuE SsF KuE YpE St UtF Ro

1 2 3 4 5 6 7 8 9 10 11 12 20 21 22 23 25 26 27 28 29 30 31 32 33 34 35 36

92 50

N

15

3 Miles 2 1 0 1 2 3

15,000 Feet 10,000 5,000 0 1000 2000 3000 4000 5000

Scale 1:31 680

GUNNISON AREA, COLORADO — SHEET NUMBER 16

N

Scale 1:31 680

3 Miles 2 1 0

15 000 Feet 10 000 5 000

1/4 0 1/2 1 000 2 000 3 000 4 000 5 000

GUNNISON NATIONAL FOREST BOUNDARY LIMIT OF SOIL SURVEY

R. 5 W. | R. 4 W.

(Joins sheet 10)

1 500 000 FEET

240 000 FEET

T. 49 N.

T. 48 N.

230 000 FEET

(Joins sheet 15)

(Joins sheet 17)

1 470 000 FEET

(Joins sheet 23)

R. 4 W. R. 3 W.

Soap Mesa

Houpress Creek

McIntyre Gulch

Dillon Mesa

Dillon Gulch

BLUE MESA RESERVOIR

Cottonwood Gulch

GUNNISON RIVER

Black Canyon

Snelson Creek

Pine Creek

Willow Creek

Sapinero Mesa

Fourmile Gulch

Pine Creek Mesa

SsF YpE KuE St PhF DrE RuE DsE Ro VuE YlE Aw Ad

Land division corners are approximately positioned on this map.

Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

GUNNISON AREA, COLORADO NO. 16

GUNNISON AREA, COLORADO NO. 17

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.
Land division corners are approximately positioned on this map.

1 510 000 FEET

240 000 FEET

230 000 FEET

1 540 000 FEET

R. 3 W. R. 2 W.

T. 49 N.

T. 48 N.

(Joins sheet 10)

(Joins sheet 16)

(Joins sheet 18)

(Joins sheet 24)

Tenderfoot Hill

Red Creek

Dry Gulch

East Elk Creek

Haystack Gulch

Willow Creek

Stevens Gulch

BLUE MESA RESERVOIR

Carpenter Ridge

Fourmile Gulch

Lake Gulch

Cebolla Creek

Kezar Basin

50

N

Scale 1:31 680

3 Miles 2 1 0 15 000 Feet 10 000 5000 4000 3000 2000 1000 0 5000

(Joins sheet 11)

(Joins sheet 17)

(Joins sheet 19)

(Joins sheet 25)

R. 2 W. | R. 1½ W. | R. 1 W.

1 580 000 FEET

1 550 000 FEET

240 000 FEET

230 000 FEET

T. 48 N.

T. 49 N.

BLUE MESA RESERVOIR

Gunnison R.

Beaver Cr.

Stevens Creek

Steuben Creek

Hierro

Elkhorn

Iola

Blaine Rock

Willow Creek

Pole Creek

Big Mesa

Spring Creek

Beaver Creek

50

149

DsE DrE EvD PhF KcE LhF DeC Ad Ao GaA St Aw Ro

Land division corners are approximately positioned on this map.

Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

GUNNISON AREA, COLORADO NO. 18

GUNNISON AREA, COLORADO — SHEET NUMBER 19

GUNNISON AREA, COLORADO NO. 19

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.
Land division corners are approximately positioned on this map.

19

N

Scale 1:31 680

3 Miles 2 1 0

15 000 Feet 10 000 5 000 0

1 590 000 FEET

1 240 000 FEET

1 220 000 FEET

1 620 000 FEET

R. 1 W. | R. 1 E.

T. 49 N.

T. 48 N.

(Joins sheet 18)

(Joins sheet 12)

(Joins sheet 20)

(Joins sheet 26)

Stubbs Gulch

Cold Creek

Basin Creek

Hen Sage Gulch

Chance Gulch

Graflin Gulch

Dutch Gulch

LUCKY STRIKE MINE

Ro KcE LhF DrE DeB EvD Ad PhF PmF DsE St Aw UtF

N

Scale 1:31 680

3 Miles 2 1 0

15 000 Feet 10 000 5 000 0

5 000 4 000 3 000 2 000 1 000 0

¾ ½ ¼

R. 1 E. R. 2 E. R. 2 E. R. 3 E.

T. 49 N. T. 48 N.

(Joins sheet 19) (Joins sheet 21) (Joins sheet 27)

220 000 FEET 240 000 FEET 1 630 000 FEET 1 660 000 FEET

Long Gulch Dutch Gulch Flat Top Cochetopa Creek Cochetopa Canyon Tomichi Creek Houston Gulch Parlin Flats MAPLE LEAF MINE

PhF LhF PmF DrE VuE BbA GaA IrA GrB EvD RhF Ad Aw St Utf TM

Land division corners are approximately positioned on this map.

Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station

GUNNISON AREA, COLORADO NO. 20

GUNNISON AREA, COLORADO NO. 21

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.
Land division corners are approximately positioned on this map.

21

N

1 670 000 FEET

240 000 FEET

220 000 FEET

1 700 000 FEET

R. 3 E.

R. 4 E.

T. 49 N.

T. 48 N.

(Joins sheet 14)

(Joins sheet 20)

(Joins inset, sheet 9)

(Joins sheet 28)

LIMIT OF SOIL SURVEY

GUNNISON NATIONAL FOREST BDY

Doyleville

Doyleville School

Wood Gulch

Tomichi Creek

Hot Springs Creek

Monson Gulch

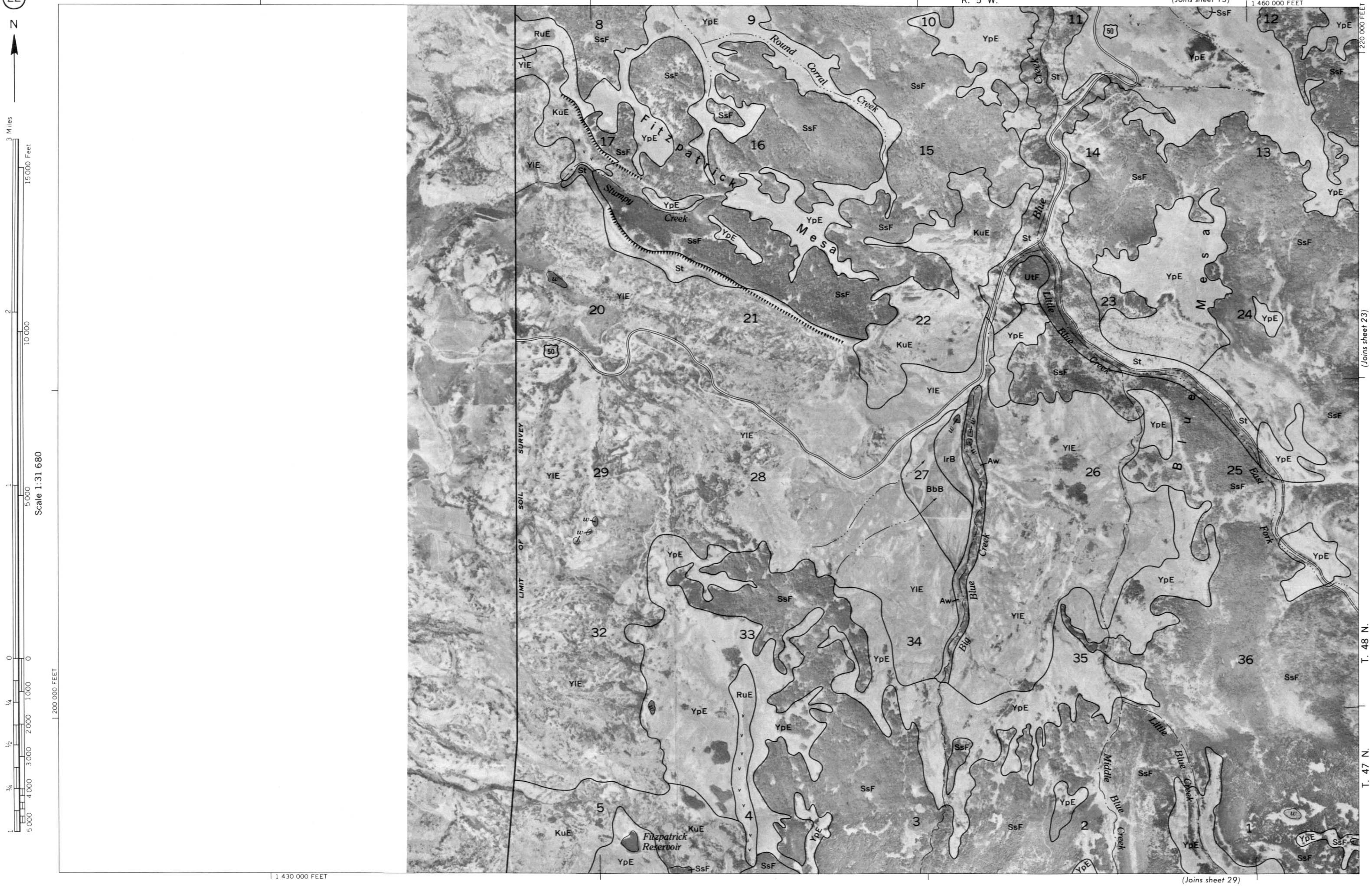
Razor Creek

3 Miles

15 000 Feet

Scale 1:31 680

GUNNISON AREA, COLORADO — SHEET NUMBER 22



Land division corners are approximately positioned on this map.

Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

GUNNISON AREA, COLORADO — SHEET NUMBER 23

GUNNISON AREA COLORADO NO. 23

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.

Land division corners are approximately positioned on this map.

1 470 000 FEET

220 000 FEET

R. 4 W.

(Joins sheet 16)

R. 3 W.

T. 48 N.

T. 47 N.

(Joins sheet 22)

(Joins sheet 24)

(Joins sheet 30)

1 500 000 FEET

200 000 FEET

N

Scale 1:31 680

3 Miles

15 000 Feet

10 000

5 000

0

1 000

2 000

3 000

4 000

5 000

Blue Mesa

Pine Creek Mesa

Willow Creek

Dry Gulch

Mesa

Lake Fork Gulch

Sapinero Mesa

BLUE MESA RESERVOIR

Gunnison River

Crow Gulch

Willow Creek

Cutler Draw

Little Blue Creek

East Fk.

SsF

YpE

YlE

PhF

VuF

KuE

VuE

LhF

UtF

Aw

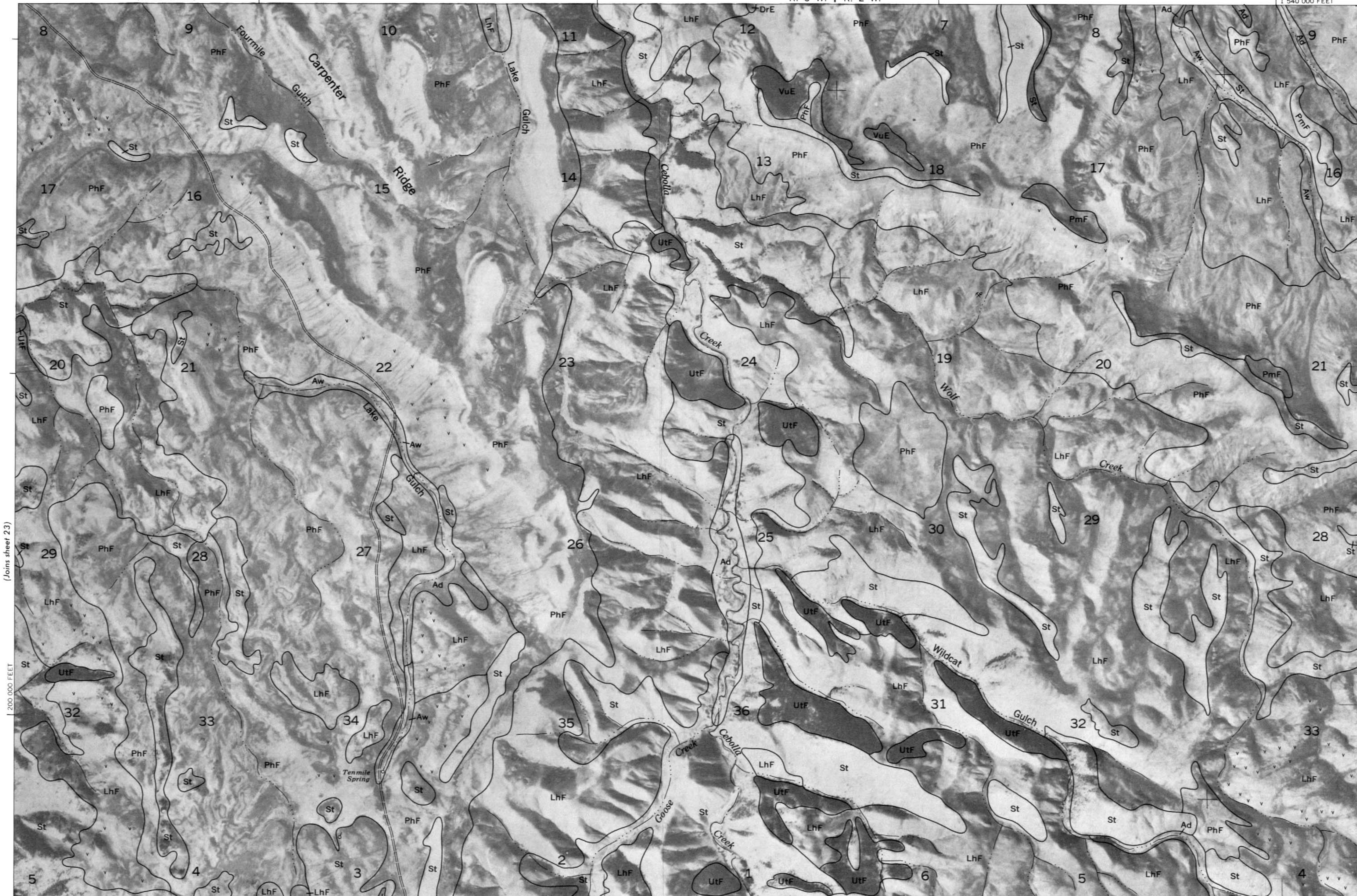
St

Ad

GUNNISON AREA, COLORADO — SHEET NUMBER 24

R. 3 W. | R. 2 W.

(Joins sheet 17)



(Joins sheet 23)

(Joins sheet 25)

(Joins sheet 31)

N

Scale 1:31 680

3 Miles, 2, 1, 0, 1/4, 1/2, 3/4, 1

15 000 Feet, 10 000, 5 000, 0, 1000, 2000, 3000, 4000, 5 000

Land division corners are approximately positioned on this map.

Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

GUNNISON AREA, COLORADO — SHEET NUMBER 25

GUNNISON AREA, COLORADO NO. 25

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.
Land division corners are approximately positioned on this map.

1 550 000 FEET

220 000 FEET

(Joins sheet 24)

(Joins sheet 18)

GUNNISON COUNTY
SAGUACHE COUNTY

(Joins sheet 26)

T. 48 N.

T. 47 N.

R. 2 W.

R. 1½ W.

R. 1 W.

(Joins sheet 32)

1 580 000 FEET

25

N

3 Miles
15 000 Feet
10 000
5 000
Scale 1:31 680
5 000
4 000
3 000
2 000
1000
0
200 000 FEET

N

Scale 1:31 680

3 Miles 2 1 0

15 000 Feet 10 000 5 000

5 000 4 000 3 000 2 000 1 000 0

¾ ½ ¼ 0

(Joins sheet 19)

(Joins sheet 25)

(Joins sheet 27)

(Joins sheet 33)

1 620 000 FEET

210 000 FEET

200 000 FEET

1 590 000 FEET

GUNNISON COUNTY
SAGUACHE COUNTY

T. 48 N.

T. 47 N.

R. 1 W. | R. 1 E.

South Beaver Creek

Long Gulch

Gold Basin Creek

Stubbs Gulch

Merry Go Round Gulch

Shisto Basin

Blackjack Gulch

Link Creek

Cooper Mountain

LhF, St, Aw, KcE, UtF, PwE, BaF, CeE, VuE, PhF, YpE, Ad, DrE

GUNNISON NATIONAL FOREST BOUNDARY

LIMIT OF SOIL SURVEY

Land division corners are approximately positioned on this map.

Photobase from 1965 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

GUNNISON AREA, COLORADO — SHEET NUMBER 27

GUNNISON AREA, COLORADO NO. 27

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.
Land division corners are approximately positioned on this map.

27

N

1 630 000 FEET

(Joins sheet 20)

R. 2 E.

R. 3 E.

GUNNISON COUNTY
SAGUACHE COUNTY

Gulch
Long
Cochetopa Creek
Canyon
Camp Kettle Gulch
Table Top
Cottonwood Gulch
Ridge
Post
Bead Creek
Poverty Gulch
Spruce Gulch
Project
LOST OCHO MINE

T. 48 N.
T. 47 N.

1 210 000 FEET

(Joins sheet 26)

(Joins sheet 28)

1 200 000 FEET

LIMIT OF SOIL SURVEY
GUNNISON NATL FOR BDY

R. 1 E. | R. 2 E.

(Joins sheet 34)

1 660 000 FEET

3 Miles
15 000 Feet
10 000
5 000
Scale 1:31 680

(Joins sheet 21)

R. 3 E. R. 4 E.

1 700 000 FEET

GUNNISON COUNTY
SAGUACHE COUNTY

Coyote Hill

Razor Creek

Needle Creek

Flat Creek

Big Draw

Barrel Creek

Needle Creek

Poverty Gulch

Snyder Gulch

Prosser Creek

Razor Creek

Vouga Reservoir

Prosser Rock

LIMIT OF SOIL SURVEY

GUNNISON NATIONAL FOREST BOUNDARY

(Joins sheet 27)

(Joins inset)

(Joins inset, sheet 9)

(Joins sheet 34)

(Joins lower left)

1 665 000 FEET

1 670 000 FEET

200 000 FEET

190 000 FEET

192 000 FEET

210 000 FEET

T. 47 N.

T. 48 N.

Scale 1:31 680

3 Miles 2 1 0

15 000 Feet 10 000 5 000 0

1/4 1/2 3/4 1

1 000 2 000 3 000 4 000 5 000

2 000 AND 5 000-FOOT GRID TICKS

Land division corners are approximately positioned on this map.

Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

GUNNISON AREA, COLORADO NO. 28

GUNNISON AREA, COLORADO — SHEET NUMBER 29

29

N

R. 5 W.

T. 47 N.

(Joins sheet 22)

(Joins sheet 30)

(Joins inset A, sheet 39)

(Joins inset B, sheet 39)

1 430 000 FEET

1 460 000 FEET

190 000 FEET

170 000 FEET

Swanson Lake

Little Blue Creek

Blue Creek

Big Blue Creek

Middle Blue Creek

West Fork Blue Creek

Little Cimarron River East Fork

Coyote Park Draw

LIMIT OF SOIL SURVEY

KuE

RuE

SuE

YpE

SsF

St

Ro

Aw

8 9 10 11 12

15 14 13

16 17

20 21 22 23 24

29 28 27 26 25

32 33 34 35 36

3 Miles 2 1 0

15 000 Feet 10 000 5 000 0

1 ¼ ½ ¾ 1

5 000 4 000 3 000 2 000 1 000 0

Scale 1:31 680

GUNNISON AREA, COLORADO NO 29

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.
Land division corners are approximately positioned on this map.

(30)

N

Scale 1:31 680

3 Miles 2 1 0 15 000 Feet 10 000 5 000

¾ ½ ¼ 0 4 000 3 000 2 000 1 000 0 5 000 Feet

(Joins sheet 23)

(Joins sheet 29)

(Joins sheet 31)

(Joins sheet 35)

R. 4 W.

R. 3 W.

T. 47 N.

1 500 000 FEET

1 490 000 FEET

1 470 000 FEET

Land division corners are approximately positioned on this map.

Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

GUNNISON AREA, COLORADO NO. 30

GUNNISON AREA, COLORADO NO. 31

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.
Land division corners are approximately positioned on this map.

N

1 510 000 FEET

1 190 000 FEET

R. 3 W.

R. 2 W.

T. 47 N.

(Joins sheet 24)

(Joins sheet 30)

(Joins sheet 32)

(Joins sheet 36)

1 540 000 FEET

1 170 000 FEET

3 Miles 2 1 0 15 000 Feet 10 000 5 000 4 000 3 000 2 000 1 000 0

Scale 1:31 680

Lake Fork Gunnison River

Goose Creek

Cebolla Creek

Wildcat Gulch

Indian Creek

Dutch Gulch

Tolvar Peak

Milkranch Gulch

Powderhorn Creek

(Joins sheet 25)

(Joins sheet 31)

(Joins sheet 33)

(Joins sheet 37)

N

3 Miles 15 000 Feet 10 000 5 000 0

Scale 1:31 680

1 580 000 FEET

1 190 000 FEET

1 170 000 FEET

1 550 000 FEET

Wolf Creek

Willow Creek

Little Willow Creek

Camp Creek

Corral Creek

Wright Creek

Milktrench Gulch

Huntsman Mesa

Soderquist Reservoir

Big Mud Pond

GUNNISON COUNTY

SAGUACHE COUNTY

T. 46 N.

T. 45 N.

R. 2 W.

R. 1½ W.

R. 1 W.

Land division corners are approximately positioned on this map.

Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station

GUNNISON AREA, COLORADO NO. 32

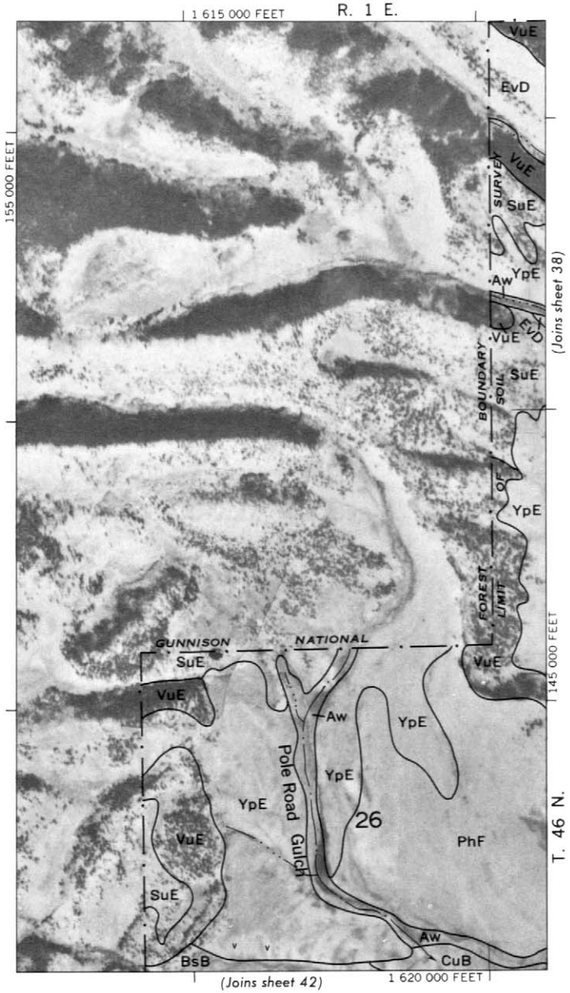
GUNNISON AREA, COLORADO — SHEET NUMBER 33

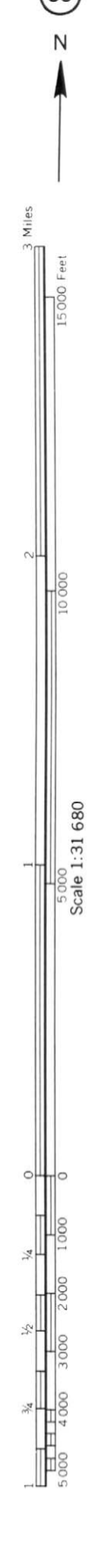
GUNNISON AREA, COLORADO NO. 33

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station
Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.
Land division corners are approximately positioned on this map.

INSET A

INSET B





(Joins sheet 27)

R. 2 E.

R. 3 E.

1 660 000 FEET

1 190 000 FEET

T. 47 N.

(Joins inset, sheet 28)

N

3 Miles

15 000 Feet

10 000

Scale 1:31 680

5 000

0

1000

2000

3000

4000

5000 FEET

1 630 000 FEET

(Joins sheet 38)

Land division corners are approximately positioned on this map.

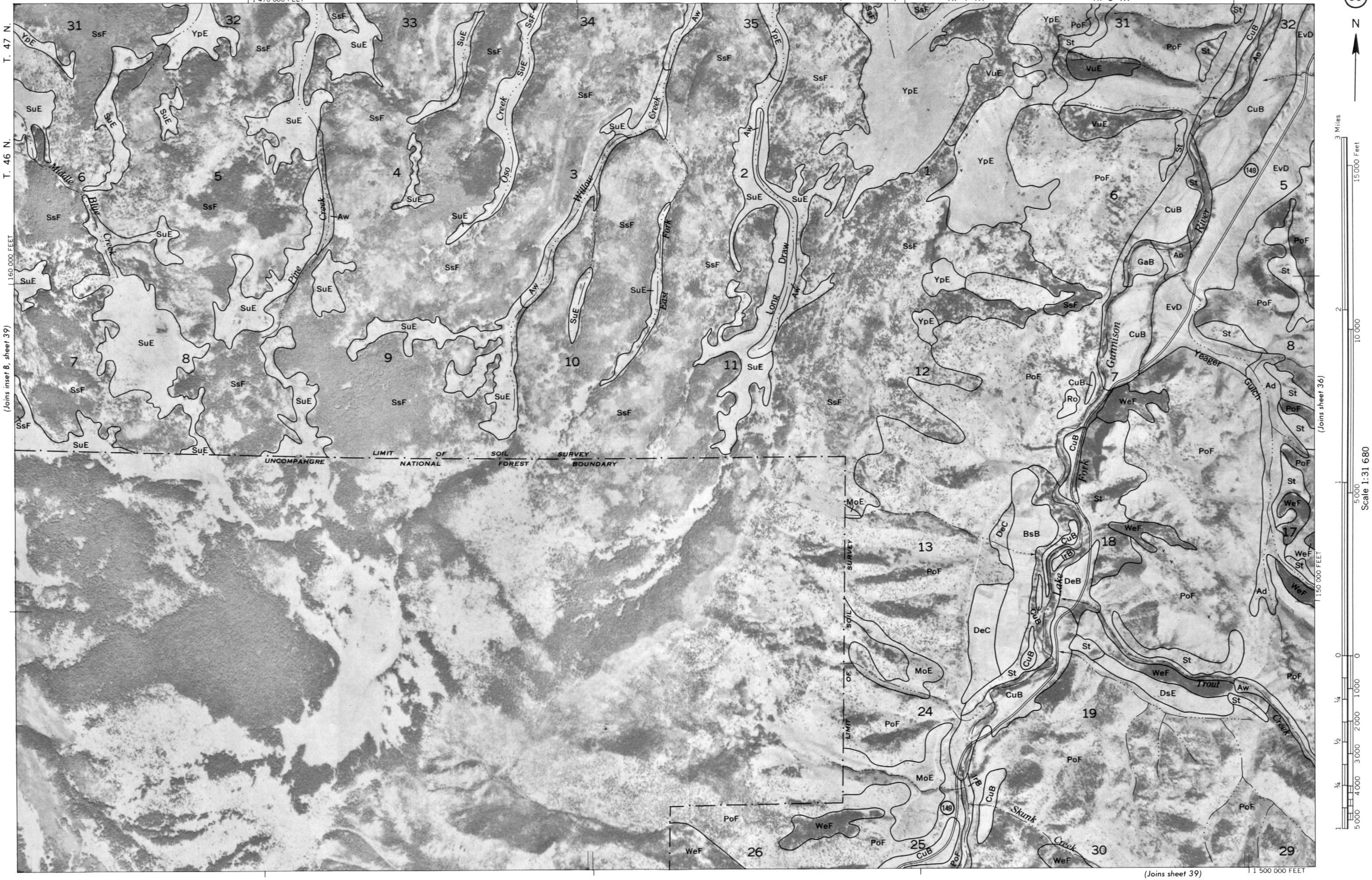
Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

GUNNISON AREA, COLORADO NO. 34

GUNNISON AREA, COLORADO NO. 35

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.
Land division corners are approximately positioned on this map.



GUNNISON AREA, COLORADO — SHEET NUMBER 36

(Joins sheet 31)

R. 3 W. | R. 2 W.

1 540 000 FEET

T. 47 N.

T. 46 N.

1 160 000 FEET

(Joins sheet 37)

(Joins sheet 35)

1 150 000 FEET

(Joins sheet 40)

1 510 000 FEET

N

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31 680

5 000 4 000 3 000 2 000 1 000 0

Land division corners are approximately positioned on this map.

Photobase from 1955 aerial photography. Positions of 10 000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

N

GUNNISON AREA, COLORADO NO. 37

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.
Land division corners are approximately positioned on this map.

1 550 000 FEET

1 580 000 FEET

160 000 FEET

150 000 FEET

T. 47 N.

T. 46 N.

R. 2 W.

R. 1½ W.

R. 1 W.

(Joins sheet 32)

(Joins sheet 36)

(Joins sheet 41)

(Joins inset A, sheet 33)

Powderhorn School

POWDERHORN CEMETERY

Rudolph Hill

Deldorado Creek

Beaver Creek

North Beaver Creek

Cebolla Creek

DeC Road

Rock Creek

COUNTY

GUNNISON SAGUACHE

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31 680

N

R. 1 E. | R. 2 E.

(Joins sheet 34)

1 660 000 FEET

160 000 FEET

T. 46 N.

(Joins inset B, sheet 33)

150 000 FEET

(Joins sheet 43)

1 630 000 FEET

Scale 1:31 680

3 Miles 2 1 0

15 000 Feet 10 000 5 000 0

¼ ½ ¾ 1

1000 2000 3000 4000 5000

Land division corners are approximately positioned on this map.

Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.

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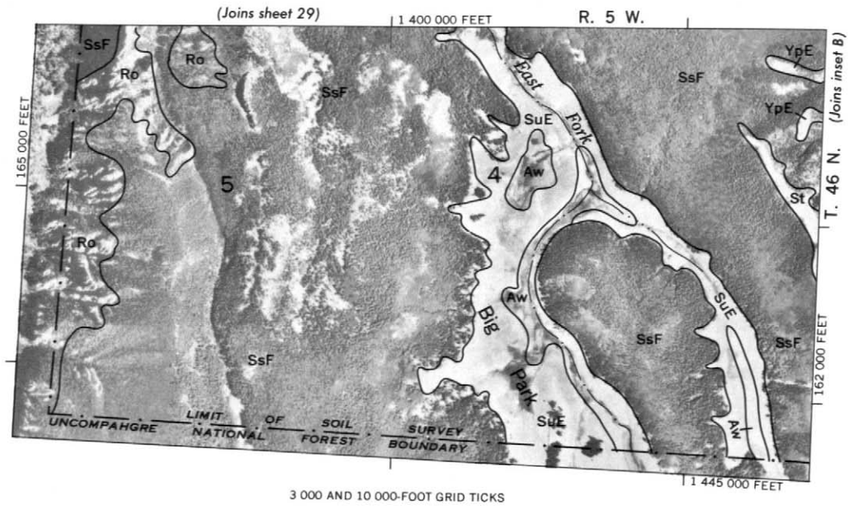
GUNNISON AREA, COLORADO NO. 38

GUNNISON AREA, COLORADO NO. 39

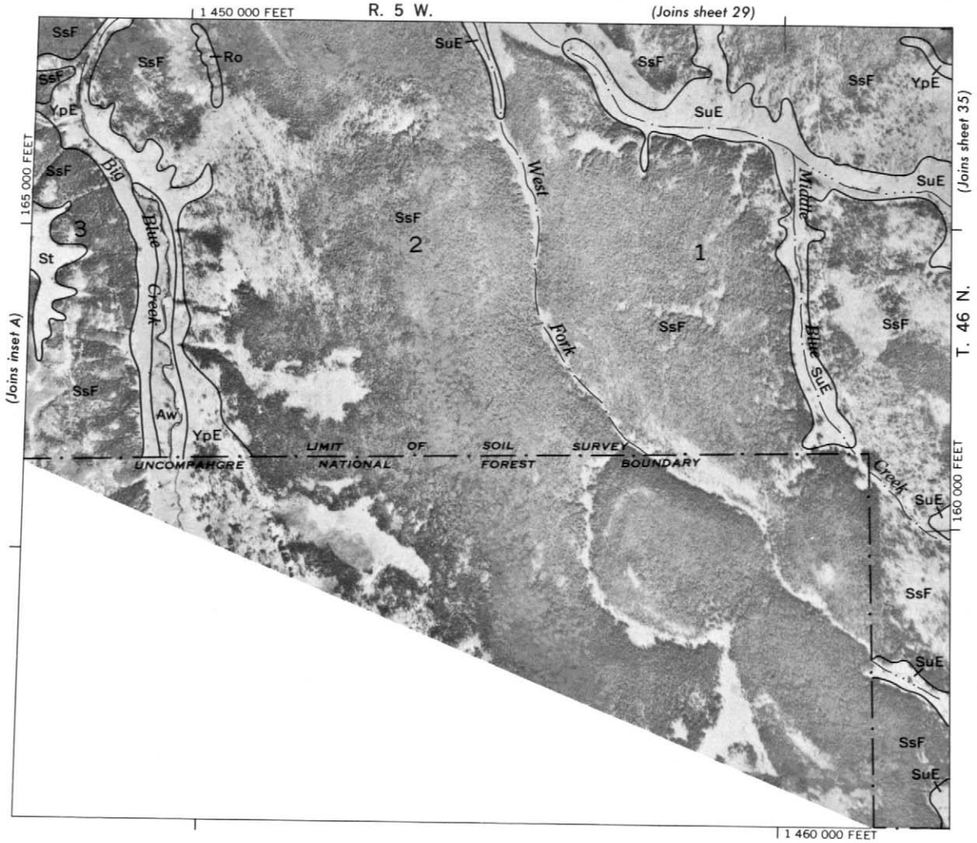
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.
Land division corners are approximately positioned on this map.

INSET A



3 000 AND 10 000-FOOT GRID TICKS

INSET B



5 000 AND 10 000-FOOT GRID TICKS

39

N

3 Miles
2
15 000 Feet
10 000
1
5 000

Scale 1:31 680

(Joins sheet 36)

R. 3 W. R. 2 W.

1 540 000 FEET

140 000 FEET

T. 46 N.

T. 45 N.

N

3 Miles

15000 Feet

10 000

5 000

Scale 1:31 680

120 000 FEET

1 510 000 FEET

(Joins sheet 41)

(Joins sheet 45)

GUNNISON COUNTY
HINSDALE COUNTY

Trout Creek

Dry Fork

Indian Creek

Powderhorn Creek

West Fork

East Fork

Middle Fork

Calf Creek

Plateau

Fourth of July Creek

MoE WeF PoF St Aw Ro VuE RyE WoF YpE SsF MeF NuF RuE

Land division corners are approximately positioned on this map.
Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

GUNNISON AREA, COLORADO NO. 40

GUNNISON AREA, COLORADO NO. 41

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.
Land division corners are approximately positioned on this map.

(Joins sheet 37)
(Joins sheet 40)
(Joins sheet 42)
(Joins sheet 46)

1 550 000 FEET
140 000 FEET
1 120 000 FEET
1 580 000 FEET

R. 2 W. R. 1½ W. R. 1 W.

T. 46 N. T. 45 N.

GUNNISON COUNTY
HINSDALE COUNTY
SAGUACHE COUNTY

LIMIT OF SOIL SURVEY
GUNNISON NATIONAL FOREST BOUNDARY

Scale 1:31 680
3 Miles 2 1 0 15 000 Feet 10 000 5 000
1 ¼ ½ ¾ 0 1000 2000 3000 4000 5000

N

41

N

Scale 1:31 680

3 Miles 15000 Feet 10000 5000

2 1 0 1/4 1/2 3/4 1

5000 4000 3000 2000 1000 0

(Joins sheet 41)

R. 1 W. (Joins inset A, sheet 33)

T. 45 N.

1 590 000 FEET

120 000 FEET

INSET A

R. 3 E.

1 665 000 FEET

130 000 FEET

120 000 FEET

1 662 000 FEET

(Joins sheet 43)

T. 45 N.

3 000 AND 10 000-FOOT GRID TICKS

(Joins inset B, sheet 33)

R. 1 E.

1 620 000 FEET

140 000 FEET

T. 45 N. | T. 46 N.

(Joins sheet 43)

INSET B

R. 2 E.

(Joins sheet 43)

1 650 000 FEET

T. 45 N.

110 000 FEET

1 630 000 FEET

113 000 FEET

3 000 AND 10 000-FOOT GRID TICKS

Land division corners are approximately positioned on this map.

Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station

GUNNISON AREA, COLORADO NO. 42

GUNNISON AREA, COLORADO — SHEET NUMBER 43

R. 1 E. | R. 2 E.

1 630 000 FEET

(Joins sheet 38)

R. 3 E.

43

N

140 000 FEET

T. 45 N. | T. 46 N.

(Joins sheet 42)

Los Pinos Creek

Poison Gulch

Archuleta Creek

Park Creek

Cochetopa Creek

Tasselgulch

Van Joe Gulch

Mexican Ant Creek

Texas Creek

Pauline Creek

Quemado Creek

BOUNDARY SURVEY

NATIONAL FOREST BOUNDARY

SOIL SURVEY LIMIT

GUNNISON LIMIT

BsB CuB GaA IrA IrB PhF RcE St SuE VuE YpE Aw

(Joins inset A, sheet 42)

(Joins inset B, sheet 42)

1 660 000 FEET

1 120 000 FEET

3 Miles 15 000 Feet 10 000 5 000 0

1 2 ¼ ½ ¾ 1

5 000 4 000 3 000 2 000 1 000 0

Scale 1:31 680

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.
Land division corners are approximately positioned on this map.

N

Scale 1:31 680

3 Miles 2 1 0 15 000 Feet 10 000 5 000 0 1 000 2 000 3 000 4 000 5 000

(Joins sheet 39)

1 500 000 FEET

110 000 FEET

90 000 FEET

1 470 000 FEET

(Joins sheet 45)

(Joins sheet 47)

T. 45 N. | T. 44 N.

R. 4 W. | R. 3 W.

Gunnison River

Devils Creek

High Bridge Gulch

Hobo Gulch

Bill Hare Gulch

Nourse Creek

Eaton Creek

Lake Fork Gunnison River

Sparling Gulch

Independence Gulch

BsB PoF WeF EvD VuE SsF YpE PhF St CuB MeF GaB Ad Ao WoF SuE DeC PmF

1 2 10 11 12

149

FOREST BOUNDARY

UNCOMPAHGRE NATIONAL FOREST BOUNDARY SURVEY

GUNNISON SOIL SURVEY LIMIT

Land division corners are approximately positioned on this map.

Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.

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GUNNISON AREA, COLORADO NO. 44

GUNNISON AREA, COLORADO — SHEET NUMBER 45

N

1 510 000 FEET

R. 3 W.

R. 2 W.

(Joins sheet 40)

(Joins sheet 44)

T. 45 N.

T. 44 N.

110 000 FEET

Fourth of July Creek

Devils Creek

Powderhorn Lakes

W. Fk. Powderhorn Cr.

Calf Creek Plateau

Cannibal Plateau

Devils Lake

Burnt Creek

Powderhorn

East Fork

Aw Ridge

MeF, WeF, VuE, RuE, St, Ro, NuF, Aw, YpE, SuE

19, 20, 24, 25, 26, 29, 30, 31, 32, 33, 35, 36

LIMIT OF GUNNISON NATIONAL FOREST SOIL SURVEY BOUNDARY

(Joins lower right) | (Joins sheet 46)

(Joins sheet 46)

1 540 000 FEET

88 000 FEET

86 000 FEET

Wood Gulch Creek

Ceboila Creek

Mineral Creek

VuE, RuE, RyE, St, GaA, FoB, WoF

1 550 000 FEET

2 000 AND 10 000-FOOT GRID TICKS

90 000 FEET

(Joins inset)

3 Miles

15 000 Feet

10 000

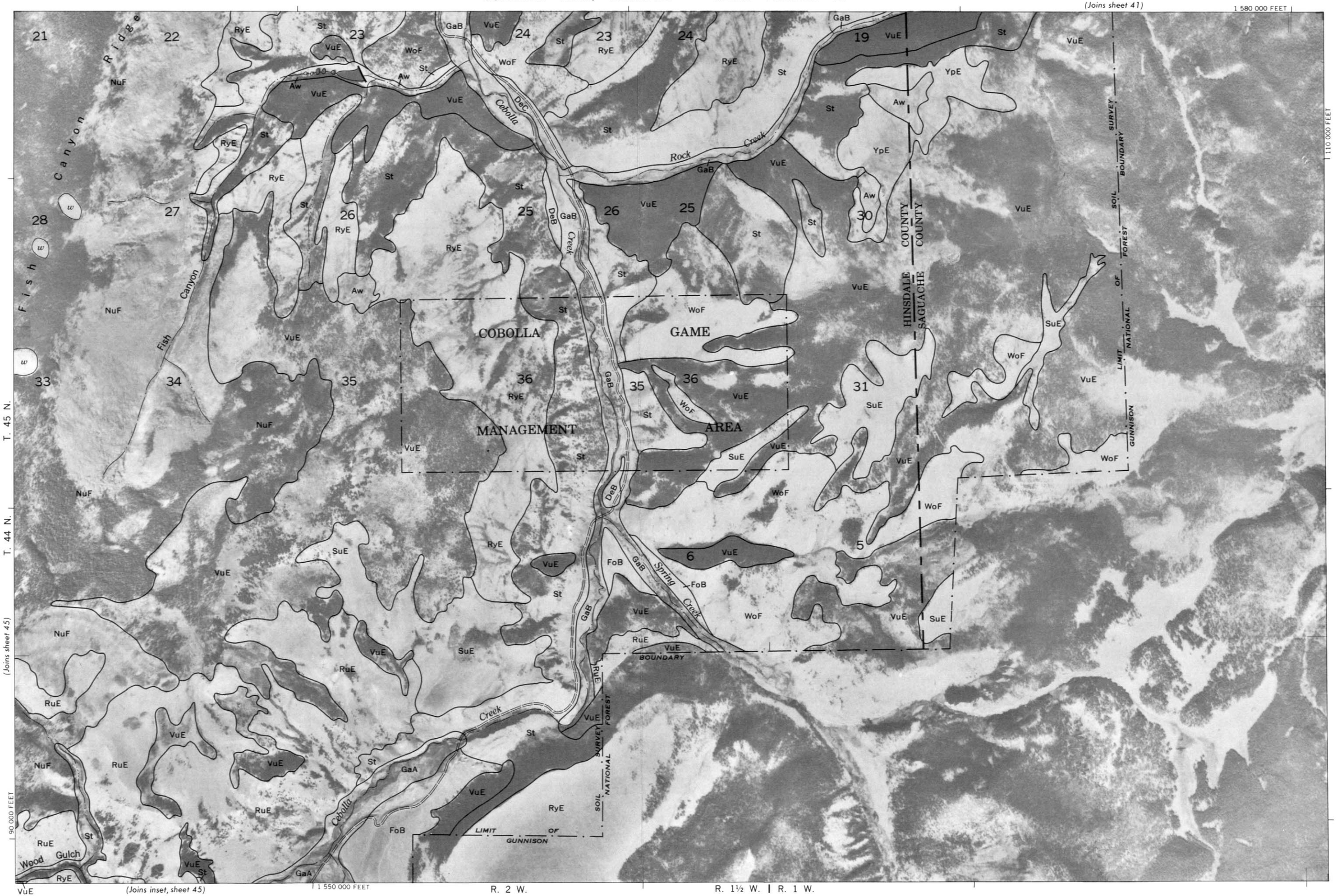
5 000

Scale 1:31 680

GUNNISON AREA, COLORADO NO. 45

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.
Land division corners are approximately positioned on this map.

(Joins sheet 41)



Scale 1:31 680

Land division corners are approximately positioned on this map.

Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

GUNNISON AREA, COLORADO NO. 46

GUNNISON AREA, COLORADO — SHEET NUMBER 47

GUNNISON AREA, COLORADO NO. 47

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1955 aerial photography. Positions of 10,000-foot grid ticks are approximate and based on the Colorado coordinate system, central zone.
Land division corners are approximately positioned on this map.

1 470 000 FEET

R. 4 W.

(Joins sheet 44)

1 80 000 FEET

T. 44 N.

1 70 000 FEET

1 500 000 FEET

N

3 Miles

15 000 Feet

10 000

5 000

Scale 1:31 680

Neoga Mountain

Lake City

Sugar Loaf Rock

Horse Park

Spartling Gulch

Henson Creek

Wade Gulch

Gunnison River

Lake Fork

Park Creek

BOUNDARY OF NATIONAL FOREST

GUNNISON NATIONAL FOREST BOUNDARY

UNCOMPAHGRE NATIONAL FOREST BOUNDARY

LIMIT OF SOIL SURVEY

15 14 13 22 23 24 28 27 26 25 32 34 35 36 6 5 4 3 2 7 8 9 10 11

VuE SuE WoF PmF GaB Ao Ad St Ro SsF CuB Aw EvD RuE YpE IrB